AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 10, No. 29 WEEKLY. | NEW YORK, JULY 16, 1887. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.

COPYRIGHT 1887, BY AMERICAN MACHINIST PUBLISHING COMPANY.

For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Multi-Tubular Expansion Boiler.

Owing to the high steam pressure now employed on steamships, and the still higher pressure that it is desirable to employ, there has been much thought and effort expended in the direction of producing a boiler that, while being of large capacity, should safely permit the carrying of the desired high pressure. It is also, of course, a requisite that such a boiler shall be light in weight, shall take up moderate space, and shall be economical in the use of fuel. Such a boiler must also be simple in construction, without great multiplicity of parts.

The boiler which we illustrate herewith was designed to meet the objections hitherto raised to boilers of this type for marine purposes; its construction may be explained as follows:

A is a vertical cylinder or water sphere, made of rolled steel plate welded or riveted. The contraction at *a* is rolled or wrought into this cylinder, or a diaphragm is placed within to contract the area of the cylinder.

The upper and lower ends of this cylinder are flanged as shown, the lower end having a bumped or dished head bolted to this flange, which forms the base of this structure.

The upper end is surmounted by a transverse steam dome *D* attached to *A*, with gooseneck flanged and bolted.

The steam dome *D* is constructed of steel plate rolled and welded, with welded heads forming a seamless cylinder of great strength and durability. *E E E* are seamless tubes or pipes bent to the required shape, and expanded into the water cylinder *A* in concentric rows, as shown. This construction obviates all cast or malleable iron fittings and screw-thread joints, a feature which will be appreciated by engineers.

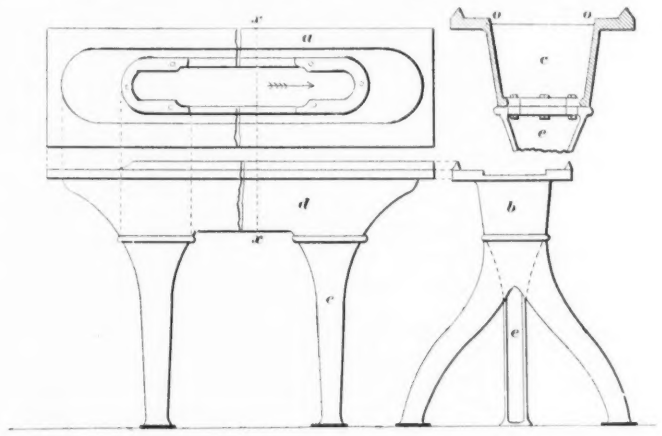
The feed and blow pipes are placed near the bottom or into the mud drum. The feed pipe having an extension inside of cylinder *A* reaching up as far as the lower tube ends.

The steam pipe is extended within the dome its entire length, with perforations on its upper side. This forms a dry pipe, and prevents the lifting of the water with its attendant danger to the engine.

For stationary uses the furnace is placed directly below the tubes, and is circular in form. The cylinder *A* has a perpendicular extension through the furnace and into the ash-pan, where it forms a mud drum or water leg. This forms a construction similar to a vertical tubular boiler in external appearance, with this advantage, that it can be erected in any confined space, as each section occupies but little room, and is of small weight in transportation and handling, and it can be easily erected at its final station. This feature obviates the necessity of breaking through walls in buildings to place a new boiler, and also recommends its use in mining districts and other places where transportation is difficult.

In these boilers the engineer has the furnace under perfect control, and can generate steam, or stop generating, at a moment's notice, no matter how heavy his fires may be, merely by opening or shutting the damper *P;* a feature of considerable importance. *G* is the grate, encircling the boiler on one side only, and facing the steam dome.

K is the cast-iron baffle plate, fitted close to the cylinder *A*, and under the center line of the steam dome. It extends outward to the jacket on each side, and its lower edge is on a line with the lower ends of tubes, as shown in the cut, thus forming two chambers, *M* and *N*, which communicate with one another only through the vacant space below the baffle-plate *K*. *P* shows the position of a semi-circular damper, working from the side of the steam dome. This damper closes an aperture to the flue *O*, and thence to the smoke stack, compelling the gases to descend downward among the tubes under the baffle-plate and upward on the other side to the smoke stack, as indicated by arrows; thus, all the gases impinging effectively upon all the heating surface contained in the boiler.



MACHINE TOOL CONSTRUCTION.

By throwing the damper *P* over, direct communication from the grate to the smoke stack is established, the gases are carried off direct without acting upon the boiler, no steam is generated, and the boiler is relieved from all unnecessary pressure. This avoids opening furnace doors suddenly and admitting cold air upon the over-heated metal, which is the cause of cracked crown sheets and split tubes, with many other annoying injuries to boilers. In keeping the fires bright, circulation can be established and steam generated very quickly by merely throwing the damper *P* back.

The following points of excellence are claimed for this boiler:

1. The water line is on a line with the upper ends of the tubes; consequently the tubes are covered their entire length with water, which prevents burning them.

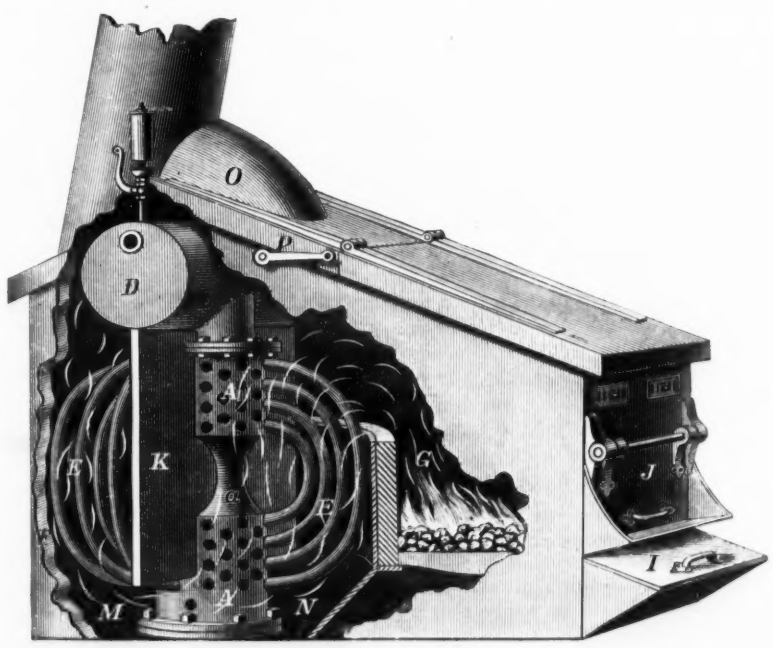
2. The vertical position of these tubes prevents the accumulation of sediment in them, and, with the forcible and rapid circulation taking place within, prevents the accumulation of scale, thus keeping the heating surface in good condition.

3. The entire construction is such that the expansion of any part of this structure is compensating, or, in other words, all parts of the whole can expand or contract independently, without starting a joint or causing any injury, as any one part has only the boiler pressure to sustain in proportion to its area.

4. It is the only water tube or sectional boiler yet invented, which is devoid of screw joints or fittings, such as elbows, couplings, etc.

5. The adoption of the side furnace for marine boilers is a feature which will commend it readily, as by its use the boiler is kept in much better control, and not exposed to sudden drafts of cold air. It also prevents the loss of water by the blowing off of the safety valve, as otherwise happens when the engines are suddenly stopped. It also permits the engineer to carry a heavy fire, when waiting for orders, without endangering his boiler; and it enables him to be at all times ready for a quick start, with a good fire and full head of steam.

The inventor of these boilers, J. W. Walters, 162 South street, N. Y., is at present building them on contract, for various uses, and proposes to put them on the market in forms to suit all purposes for which steam boilers are required.



MULTI-TUBULAR BOILER.

Machine Tool Construction.

BY F. G. WOODWARD.

In the AMERICAN MACHINIST some time ago it was suggested, among other things, that all lathes and planers should be placed on three instead of four legs, placing two legs at the heaviest end of the machine and one exactly central at the other end. Undoubtedly the best way to secure the most correct poise and action of any machine is to place it on three supports placed as above stated. This relieves the machine of all torsion strain. If all of the four-legged machines now at work could be correctly tested it would be found probably that the largest share of them were virtually resting on three legs; that is to say, it would be found that one of the four legs was sustaining much less than its due portion of the weight of the machine, thus inclining the bed to a constant tendency to twist.

The present sketch shows what is deemed to be one of the best designs for a three-legged machine; *a* is the bottom plan of bed; *b*, end view of bed with legs attached; *d*, side view; *c*, cross-section as at *x*, looking, as indicated by the arrow, towards the single leg *e*. The legs are of the semi-circular shell pattern with a plain ogee termination at top and bottom; they are held to the bed by three bolts each, by inside flanges as clearly shown. The design is such as to give the moulder an easy job, requiring no cores and having an easy draft or taper both inside and out. The sketch is made with considerable care, so that any patternmaker or machinist will comprehend fully the idea.

For machines of considerable length, say from 8 to 12 feet, the center of the legs should be placed 16 to 20 inches from the end of the bed, as shown. In the sketch the center of legs is 18 inches from end of bed. The track of the tool carriage is placed at the extreme edge of the bed, so as to leave no ledge outside to catch chip. The head and tail stocks being fitted to the corners at *o* do away with the usual gutters between two V ridges. The usual practice is to plane two V tracks on lathe beds, and fit the head and tail stocks to the inner track. This style forms a gutter, of course, which is an exceeding annoyance to the lathesman in keeping it free from chips.

Exit the car stove from the railroads of New York State, May 1, 1888. The bill decreeing that they must "go" has been signed by the Governor.

Discussion of Topical Subjects by the Master Mechanics' Association.

DUTY OF CYLINDER OIL.

The discussion of topical subjects being in order, Mr. Burford (Memphis & Charleston) asked what is a good average run to a pint of cylinder oil? I think 75 miles is a good average; some say they run 175.

SECRETARY SETCHEL: I do not really get the drift of the gentleman's question. As I understand him he asks how much oil is needed to run 75 miles. (Mr. B. repeated his question.)

It seems to me that that would depend upon the condition of the train, the engine, of the valve surface, the cylinder surfaces, how much water carried, and rather more than anything else, upon the man that is running the engine. If an engineer running for me should not be able to come up to the average run on a pint of oil, I should endeavor to find out the reason. An engine running under steam continually might and would run a great deal longer than an engine shut off. On a hilly road the engineer would have to give his engine a little oil on every grade.

MR. MACKENZIE: Mr. B. does not give us his experience. My experience is that running 116 miles on a passenger engine we have just as good results as if we had run ten. We have one engine that has run as high as 232 miles on a pint of oil.

MR. HATSWELL: I would like to ask Mr. Mackenzie what appliances he used on his road for lubricating the cylinders.

MR. MACKENZIE answered that he used the Detroit and the Northern automatic lubricators. We have run as high as 360 miles to a pint on a test but do not follow it up. Our average, though, is 59.

MR. BRIGGS: I found a great deal of trouble with the use of cylinder oil until I began to use the automatic lubricator. It was customary on the road I was connected with for the engineers to buy oil rather than be defeated while in competition with one another. In September of the year that I commenced making comparisons, our valve oil cost us 24.3 cents per 100 miles; in October of the next year we commenced using the automatic lubricator and it reduced that to 18 cents per 100 miles. We first used the Galena oil, the last oil, the valvaline oil, I think it is called; this was in 1884 or 1885.

PRESIDENT JOHANN'S experience had been that the mileage for oil and coal did not always represent the greatest economy when the apparent cost was lowest.

PRESSURE OF STEAM.

MR. LAUDER: I think, perhaps, a little discussion on this question of the desirability of carrying increased pressure would be as profitable a subject as we can now take up. There is a feeling among the progressive engineers, locomotive, marine and stationary, that we should carry higher pressure. This has come about largely by the enormous reduction of expense in operating marine engines where the cylinders have been compounded. To do that economically you must start with high pressure. How far that principle can be carried out is an open question. There are good arguments for it and some against it. I do not believe it is economy to cut off steam on a 24 inch stroke cylinder, shorter than 6 inches with the ordinary valve motion. We have gone along for years at about 140 pounds. A good many have got up to 150, a few have got more than that. Mr. Underhill has been carrying 160 pounds with, it is claimed, good results. Mr. Stevens, of the Lake Shore, has put to work passenger engines carrying 180 pounds. I have got up to 175, and I think with good results. The fact is the transportation department is calling on us every day for greater duty from our engines. Cars are built heavier, and we are expected to haul more tonnage than a few years ago: the tendency seems to be in that direction. The consequence is we have had to increase our engines. We have them now up to the maximum weight and size. It is impracticable, it seems to me, to get much above the weights we have now on our heavy passenger and freight engines. The question is how to get more power without increasing the weight. Some say the power of passenger engines is dependent on their adhesion. That is true to some extent, but there is very little difficulty from the slipping. The power of a passenger locomotive is just her capacity to make steam. She has adhesion enough. I am speaking of a good modern engine. There are very few engines that will hold steam while cutting off over 10 inches. If you can get a boiler in the engine that will carry higher pressure you have got the engine. In my own practice one of the engines that is carrying 175 pounds of steam is pulling our boat train. It is composed of sixteen cars, eleven being 60 feet long. We never have had an engine on that train that would make the steam to pull that train over in proper shape until these engines were put on. These engines have a large boiler, nearly 1,500 feet of heating surfaces, that enables them to make steam freely. When we strike a heavy pull we cannot have engines that will go down, down, down to 100 or 80 pounds. I claim a boiler can be designed to carry 200 pounds of steam as safely as one can be built to carry 100 pounds.

MR. HOWISON saw no reason why steam of 200 pounds pressure should not be used, and wanted it superheated at that.

MR. H. M. WHITNEY asked if Mr. Lauder had trouble in lubricating valves and pistons.

MR. LAUDER answered that he used automatic lubricators and balanced valves, and there was no trouble from want of lubrication.

MR. L. M. AMES moved that it is the sense of this meeting that it is not desirable to carry steam over 155 pounds pressure for freight engines.

MR. HICKEY thought the pressure to be carried should depend on circumstances. There was first the kind of boiler in use, and then the weight on the drivers and size of cylinders. Agreed with Mr. Lauder that increase of boiler pressure was preferable to increase of cylinder. Had some experience with superheated steam, and found it made lubrication so difficult that loss resulted from its use, when the expense of the extra appliances and the extra friction were taken into account.

MR. LAUDER said that high pressure steam was not so important for freight service as it was in passenger locomotives.

MR. BURFORD spoke in favor of high steam pressures for all kinds of work where hauling had to be done.

MR. SINCLAIR differed from Mr. Lauder as to high steam pressures being more valuable for passenger than for freight service. Freight engines are by far the most numerous, and a great part of the work is done in 12 inches, which admits of no expansion to speak of. Many passenger engines do their work in 6 inches, and must already have the steam reduced by throttling, to keep them from running too fast. Now take the freight engine that is working at 12 inches, and increase the steam pressure 20 or 30 pounds, and you will be able to pull back the lever a notch or two, and get the benefit of the increased expansion. It also gives the means of doing a given work with reduced size of cylinders.

EXTENSION SMOKE BOXES.

SECRETARY SETCHEL raised the question: Is the extension front, as applied to the locomotive, economical? He did not think railroad companies in the Northwest were using the extension front so much as it is used in Eastern States. While there is a difference of opinion among us regarding this device, it becomes us to find out whether this arises from local prejudice or from a better cause, and whether the extension front is good for nothing after all. It seems to me, if it is good for anything it is good for preventing the throwing of sparks, and will, when rightly applied, prevent in a great measure the starting of fires along the track. I will not say that it is a great saving of coal, but it must effect some saving in this respect. The continuous draught enables you to run with a light fire, which is the secret of saving. Old roads that have used the extension front for years would not do without it on any account.

MR. LAUDER: For the past three years I have been using the extension smoke arch exclusively; that is, putting them on to our old locomotives as fast as we can get them into the shops. We have substantially all of our engines equipped thus. Of course we use the high exhaust and also the single exhaust, which works very much better where the extension is used. There is a very soft pull on the fire by our engines. What sparks do pull through the flues are almost entirely deposited in the front end of the engine. To give the gentlemen present an idea of how critical the passengers are about Boston in this matter of sparks (on our road any way), they are so critical that having once ridden behind an engine with a straight stack, if we put an engine on with an old diamond stack there would be a row: that is a fact. And while you are not perhaps troubled with such a critical class of passengers in the West as in the East you have got to come to it; something that will prevent the emission of sparks that are thrown out by the ordinary stack construction. In the matter of smoke we are not troubled to the extent you are in the West. But of course, unless we have the proper appliances we have some smoke from bituminous coal. Without a large boiler and careful firing it will be impossible to prevent the emission of smoke, but with a large boiler with straight stack, extension front and arch evils of smoke will almost entirely disappear. Now with reference to the proper arrangements of the pipes while the extension is used. I soon found there was a difficulty in getting sufficient draught, the pipes with the exhaust and the baffle plate so completely filled the arch up that it was difficult to get proper draught. In the engines recently constructed, instead of bringing the exhaust pipes out of the bottom in the usual way I bring them out where the steam pipes usually go in and then bring the steam pipe out behind, next to the flue sheet. This makes the cylinders rights and lefts; but this cannot be done away with. My object was to leave a clear draught, and it does it admirably. I know the draught of the engines has been improved very much, and it prevents entirely the tendency to back up the sparks back of the exhaust pipes. I have less trouble with the flues at the back of the boiler stopping up. This I mention not to blow my own horn, but it is a step in advance. In setting fires I think that the extension front, when properly arranged, the baffle plate put up as it should be, will almost entirely prevent the setting of fires by sparks from the smoke-stack. We have perhaps on one division of our road, on Cape Cod, as bad a place at certain times of the year as can be imagined. We have what we call the pine needles; they are very inflammable, as much so as gunpowder. We expect to pay some damages in the future, but do know that the danger from setting fires has been largely decreased by the use of the extension smoke arch. In no case have we failed to make steam better; I do not think there is any saving of fuel, however.

SECRETARY SETCHEL: I have just been reminded that the Northern Pacific and Manitoba roads both use the extension. The Rock Island lines do not use it at all, and a number of other roads do not believe in it. It is for their benefit as well as our own that we should discuss this matter. If we can only bring out an expression from such a body of mechanics as this it will arrest the tendency to taking these out.

MR. JOHN HICKEY (Milwaukee, Lake Shore and Western): I believe that the success of the extended front on the locomotive depends on the manner in which it is constructed. If improperly constructed it is certain to fail; if properly so, certain to be a success. We have to-day over 40 locomotives equipped with it, and although we experimented over a year, I have to say it is not only a saving in fuel, but a great saving in not having sparks starting fires. It saves the material in cone and netting. I believe it is the proper way to construct the front of a locomotive. It should have by all means a tight front end and a properly constructed smoke-stack, also have the deflector plate at its proper point, all of which will be found by experience and by looking up some records we have made, and some drawings we have on hand. I believe the day is coming when every locomotive will use the front end.

MR. WM. SWANTON (Pittsburgh, Cincinnati and St. Louis): About three years ago I commenced putting these on and have continued so to do. At present we have about 80 running with extension fronts. A few engines were placed on our road lately that did not have them, but had the open stack and netting in ordinary sized smoke-box, and the fires they were said to have caused were equal to the value of the engines. I was ordered to take those engines off until I could put the extension front on. We do not claim there is any great economy in fuel, but so far as comfort, cleanliness and fires are concerned there is economy.

MR. MACKENZIE: I am one of those who do not believe in an extension front end. Experience has taught they are not what they say they are. Five thousand pounds additional weight on the front truck is so much dead weight. Economy in the use of fuel is largely in favor of the common front end. With a properly constructed front end with the brick arch, we get less smoke, and better result with a run of coal, and do not set any fires. To illustrate that, I will say an engine, to run 140 miles, will fill that front end twice, or nearly so, on a heavy train; and when once full, it is far more dangerous than an ordinary stack. I can cite cases along the line of our road. The B. & O. use the front end, and in case of dispute with another road about a fire, the B. & O. claimed the engine that had the diamond stack on set the fire; but when the evidence came in, it was shown that the one with the front end on had caused the fire, because she had run 150 miles and had not been cleaned out. With a properly constructed diamond stack, with a good large exhaust nozzle and a brick arch, I believe there is more economy than in the extension front.

MR. BURFORD: My experience is that the diamond stack is more expensive than the other. I am in favor of the extension front, as we have had less fire.

MR. H. L. COOPER (Lake Erie and Western): In 1858 the H. & St. J. were using the extension front, and the Wabash, and I think they will get sick of it now. As if it was necessary to catch a car load of sparks! With these extension fronts we ride behind, you can hold your hand out of the window and catch sparks any time. For the engines we are running I have fifty-two or fifty-three equipped with the straight stack, with a long nozzle, and we do not have any trouble with fire, and on a good many of the engines we use 4×4 No. 11 wire netting. I have had them running two and a half years, and the netting and smoke stacks have not cost me a dollar. There is not only the reduction in the first cost, but in the tin roofs and paint on our cars; the cost of these has been reduced by this device. It is the same thing as the extension front, only does not have the extension. It is nothing new. I do not believe in paying $100 for an extension front and putting it on where you do not want it.

MR. TOWNE, in a long speech, accused the association of making no progress. He was particularly hard on those who had adopted the extension front, and intimated that it was a backward movement, as the device had been twice tried and abandoned in years gone by. Considered the work of cleaning cinders out of extension fronts to be wasted labor. Said the right way was to cause the exhaust to throw the sparks into the prairie. Although not now in railroad service, he has read the reports carefully, and considered

the association was not making satisfactory progress.

MR. LAUDER: After the scolding we have heard, I would suggest that a motion to dissolve this association would be in order.

MR. SINCLAIR: I have been in the habit of paying very close attention to the proceeding of this association. I do not believe there is a man belonging to it who has read the whole reports with greater care than I have done. I am very strongly under the impression that the reports have always improved over those that went before them and showed the very strongest signs of progress. The association has the very best testimony in its annual reports of what it has been doing and the progress made. That the extension front has been tried again, is, I think, a sign of progress instead of the opposite. The extension front has come in because it has been found it would keep the sparks in a place where they could do no harm. If the master mechanics of the country are able to carry their sparks to the end of the road and not raise fires they are certainly going on the line of progress. The extension front is being brought into use because all kinds of stacks have been tried and have been found wanting. If you can put an open stack and plain front end on without any netting or cone or other spark arrester, you are going to have better work from your engines; but that is impracticable. The best thing to do is to use the device that will obstruct the draught as little as possible and not throw the sparks. Every one who has tried the extension front and put it on properly admits it prevents sparks when not full.

MR. TOWNE: I did not intend to cast any reflection on the progress made by this association. You have made progress and very great progress. My idea was to impress upon the minds of the members of the convention this particular subject. This is a subject in which all the railroads are interested and will command perhaps greater credit if properly handled than any other subject I know of.

MR. ROBERTS: I am very much in favor of the extension front. Have had considerable experience with that, and must say that I am more in love with it now than I could expect to be. We use the 3½ mesh netting, 13 wire gauge, and though not able to overcome the fine ashes that get into the passenger's eyes and ears, we do stop throwing out any sparks sufficient to damage any shops we pass or roofs of cars, or burn property. In regard to weight, I think you will find the necessary extension will not exceed from 1,000 to 1,500 pounds. The objection raised to them by a great many roads is that sparks will get on fire, warp the sheet, and the engine be delayed for repairs, and the master mechanics will feel sore. I investigated this matter and asked some roads' opinion. There were some engineers who spoke very kindly of them, but it was through faulty workmanship. Our officers ordered to have this device and we have not abandoned it yet. We all know of the feeling against the use of new devices; engineers are against them. I remember when the injectors first came in, the engineers would not use them. See how many roads in this country are using them now!

MR. JOSEPH WHITLOCK tried the extension front against his will, but its performance convinced him that it was the best spark arrester he had ever seen tried. Had extension fronts running five years without change of netting.

MR. E. L. WEISGERBER (Baltimore and Ohio) had used the extension front for many years, and the merits of the device as a spark arrester and means of saving coal made it so popular that the company ordered it on all classes of locomotives.

MR. SPRAGUE thought that the defective work was the cause of the extension front proving a failure on some roads.

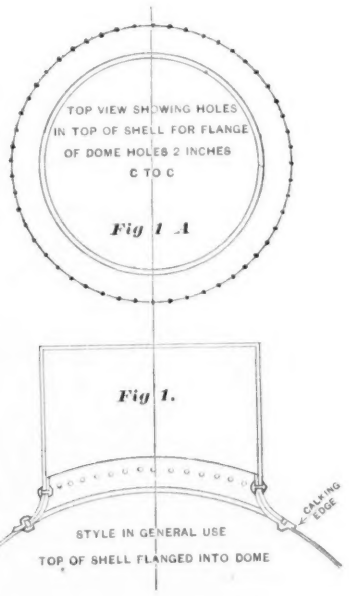
MR. BRIGGS thought the extension front the best spark arrester he had seen tried. Had experience with an engine that pulled a train 150 miles without emptying front, and then had but few sparks in the box. The reason of this was, that the nozzle was so large that the sparks were left in the fire-box, where they belong. Wanted to have standard form of extension front adopted.

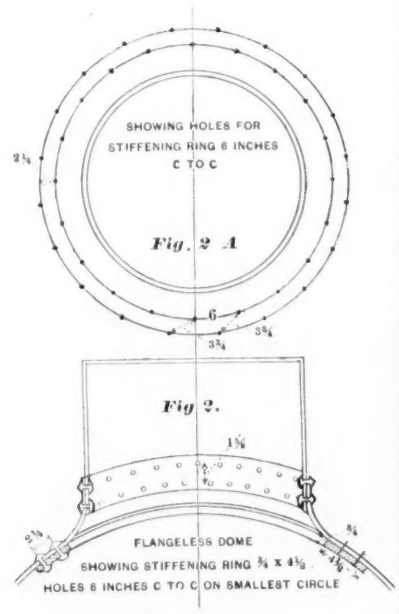
MR. HICKEY had netting in extension fronts that had been in use four years. If the cinders in the front end took fire it was a certain sign of air leaking in, and an air-tight smoke-box was essential to the successful use of the extension front.

MR. SETCHEL was ready to take any diamond stack engine, and by changing to the extension front show a cleaner train, less consumption of fuel, and less fire raising on the right of way. Putting on an extension front and open stack enables steam to be kept up after increasing the size of nozzles ½ to ¾ inch. Wanted to know if this meant nothing in the line of saving? Mentioned case of a road that he was appointed to, which had failed to make the extension front a success, and it was known as the dirtiest road in the country for passenger travel. He made it one of the cleanest roads to travel on by making the extension front a success. The extension front is being brought into the courts, owing to its success as the best known means of preventing the throwing of sparks. Believed that on the roads where the extension front was a failure that firing was done in the heavy careless way that prevailed where the diamond stack is used.

MR. MEEHAN: When I joined the Cincinnati Southern in 1881 they were using the old diamond stack or the stack in use now where the diamond stack is used. In 1881 that company paid $33,000 for damages through fire. The president of the road appealed to me, asking if I could do anything to prevent the great loss the company were monthly incurring by setting fire to property. I inquired round and Mr. Setchel told me about an extension smoke-box that he was using. I applied it to some engines, but they would not steam. They had been used on passenger service and caused delay, so I took them and put the engines on freight trains till I could experiment to find out the cause of the trouble. I soon found out how to make the engines steam first-class, but the extension soon filled up with sparks. To prevent this I introduced fire-brick arches in the fire-boxes. The brick arch and the extension front work in harmony. At that time we had 32 engines 17x24 inches, and 16 engines with cylinders 18x24 inches, and the coal consumption was 91 lbs. to the train mile. The fuel consumption per mile is now 62 pounds per train mile, notwithstanding that a large percentage of our engines are much heavier than they formerly were, many of them being consolidation engines. Every engine is equipped with the extension smoke-box and brick arch in fire-box. Have not paid a dollar for fire since the road has been thus equipped. On one occasion the general manager told me that a certain road had introduced a new system similar to mine, only without an extension, and the engines were giving just as good satisfaction as the engines equipped with extensions. I sent a man to investigate and report. On returning he said the engines would do well on a light pull, but when they came to a heavy grade they would throw sparks enough to light up the whole country. The cost of the extension is nominal outside of the brick arches. The brick arches we use are five, at a cost of sixty cents: we use two set a year. If the extension is put on properly—tight—you will never have any trouble with it. In the second place, if you introduce the brick arches, it will prevent the sparks being carried into your extension. It will be found to be a most wonderful economizer of fuel. On the third year we had everything equipped.

The discussion was then closed and the meeting adjourned for the day.





American Water Works Association.

This association will hold its seventh annual meeting at Minneapolis, Minn., July 13, 14, and 15. Judging by the subjects as given in the programme, and the names of the authors, the meeting will be an interesting one. This society already has a membership of nearly 250, and its yearly proceedings make a large volume containing much interesting matter, which proves of value to those engaged as superintendents of water works.

Domes on Boilers.

BY JAMES HERON.

I noticed in your issue of June 4th, page 7, that "W. Barnet Le Van" has reprinted his paper on the weakening of steam boilers by cutting holes in the shell for domes and necks.

If that is the strongest argument in favor of domeless boilers, that, in my opinion, can be easily remedied. I have experimented to a considerable extent in this matter. I was foreman boiler maker in N. Y. E. R. R. shops, Ninety-eighth street and Third avenue, in 1882. We had a great deal of trouble with our domes and dome sheets of shell, commonly, but erroneously called "wagon top." The domes cracked at the saddle. I had to take off thirteen or fourteen, and in almost every instance the sheet under dome was fractured to the same extent as flange of dome. I proposed to cut out dome sheet of shell, and replace it in the manner as shown in Fig. 2. This was done, and we had no further trouble with that boiler during my stay with the company. You see, by this method you avoid cutting away so much of the surface of the plate, besides avoiding that weak spot marked in Fig. 1 "calking edge" of dome flange.

I tested my system without stiffening ring, under the supervision of J. D. Campbell, of the road, with results as stated. We made two domes, 12" diameter, and two dome or top sheets, all of $\frac{5}{16}$" steel, dome sheet rolled to radius of 12", and flange the same as Fig. 2. We stiffened dome sheet with angle-iron, $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{8}$", bent to the same radius as top sheet, and riveted on ends of same. We then put 2×2 solid ring in top of dome, and tested on hydraulic press, and in both cases the rivets, ⅝" diameter, sheared at solid ring, pushing ring completely out of dome, without showing the least sign of indentation at radius of flange, or any perceptible weakening at joint, where the top sheet connects to dome. I cut several of the rivets out after test, but found no sign of tearing or stretching at holes. It will be said that to get so much flange on top sheet, that material will thin out; but this can be avoided by the use of Jas. Connery's upsetting tool, which I used on the occasions referred to, and which should be put in the hand of every flange turner. I had seven inches of flange, measured from back of flange; but 5½" is sufficient for all practical purposes, as dome can be bell-mouthed a little at bottom, to lap over radius of flange of top sheet. I drilled a 2½" hole in center of sheet, to be flanged to 24¾, to allow a 24⅝ dome outside diameter to enter this, and have done without the aid of a block. I used the old dome for that purpose, before cutting flange off same. Then I made the diameter larger, to allow dome to go inside. The flange was calipered by the general foreman, and found to be of equal thickness throughout. I have since that time done the same job on another boiler, commencing with a 6" hole, having a finish flange, 5½" from back of same, and a thickness of plate equal throughout dome, 28" diameter.

A correspondent writes us in regard to an item which we published, in relation to a strike in Bolton, England. He thinks that as bad or worse things are done by employers in this country. Nothing, he says, is allowed for over-time in many shops here, and in others, time and a quarter. Altogether our correspondent, whom we assume to be perfectly honest in his criticism, argues in a way to lead us to think he believes that times are better for a mechanic in England than in this country. We hope he is right, but shall continue to doubt it, as long as the tide of immigration sets strongly this way. Mechanics are shrewd observers, and contrive to get well informed on those parts of the world that offer the best inducements to them. When their prospects are better in England than they are here, we have no doubt we shall see them going that way. This is certainly what we should advise. Every man who works for a living—and that comprises the greater part of the population of the globe—owes it to himself and family to do the best he can in the way of wages.

The discussion by the railroad master mechanics as to the advisability of carrying higher steam pressure is only in line with that going on amongst all steam users. Marine engineers are feeling their way along to higher pressures, without signs of reaching the limit, but conditions are different in marine practice from those prevailing in locomotive practice. But a movement in the line of determining the economical limit for locomotives will be of great benefit in stationary engine practice.

The Cleveland *Press* calls the attention of all interested in improved railroad appliances to an Ohio minister who recently married three couples in a railway train. It regards him as the most successful car coupler yet invented.

The citizens of Cleveland, Ohio, having exhausted the probabilities of finding natural gas near enough to be available, now propose to turn their attention to making cheap artificial gas for manufacturing purposes.

Speaking of cranks, Geo. H. Babcock says that unless a man is enthusiastic enough in his business to make him somewhat of a crank, he is not likely to accomplish much.

Practical Drawing.

By J. G. A. Meyer.

TWENTY-EIGHTH PAPER.

SHADE LINES.—CONTINUED.

284. In examining the plan *N* of the prism shown in Fig. 195, and the plans or horizontal projections of the truncated prism, Figs. 189 and 190, the reader who may already possess a knowledge of drawing will observe that the arrangements of the shade lines in these plans or horizontal projection do not agree with the arrangement of shade line in the plans of ordinary working drawings. In differing with the customary arrangement of shade lines, the writer does not wish to be understood that it is his intention to introduce something new, or to find fault with custom, or to inaugurate a reform in the arrangement of shade lines; but he wishes to be understood that it is his intention to point out the correct arrangement of shade lines as others have done before; and since there is only one correct way of doing things, the writer believes it to be best to know the correct way, and then if custom compels us to do otherwise, it will be an easy matter to conform to it. The difference between these arrangements is small. Now let us see wherein the arrangement of the shade lines in these figures differs from ordinary practice. Take for instance the plan *N* in Fig. 195; here the upper edge *e f* and the right hand edge *f* b_2 are represented by shade lines, whereas had we placed these shade lines according to custom, the lower edge a_2 b_2 instead of *e f* and the right hand edge *f* b_2 (as before) would have been shade lines, and similar differences will be found to exist in the position of shade lines in our figures when compared with ordinary working drawings.

Our next step, then, is to inquire into the cause of this difference.

The shade lines in our figures are arranged in accordance with the definitions of shade lines and principles connected with them as given in Articles 268 to 279; these definitions and principles have been taken from standard books treating on shades and shadows.

On the other hand, custom arranges the shade lines in accordance with the following rule: "The lines representing the lower edges, and right hand edges of straight surfaces shown in all plans and elevations must be shade lines." A rule of this kind must be accepted with caution, as it does not thoroughly cover every case; and when applied to the lines in a plan of an object will lead to incorrect results. Here again a question arises: What incorrect results are obtained by applying this rule to the lines in a plan of an object? It is simply this: We have seen in article 279 that a line which represents one and the same edge in the various projections of a solid or any other object must either be a fine line or a shade line in all the projections; but if we now arrange the shade lines according to the rule as used in practice, such results will not be obtained. Take for instance the plan *N* in Fig. 195; if the shade lines had been arranged according to this rule, then the edge a_2 b_2, as stated before, would have been represented by a shade line, which would mean that this line separates an illuminated and a shade surface; but the line a_2 b_2 in the plan and the line *a b* in the elevation *M* represents one and the same edge, and according to the rule the edge *a b* in the elevation must be represented by a fine line, which would mean that this line separates two illuminated surfaces. Here, then, we have a drawing which in reality says in one place that a line separates an illuminated and a shade surface, and in another place it says that the same line separates two illuminated surfaces; now, to say the least, such statements are contradictory, and consequently incorrect, if not absurd, and such contradiction should not be found in a working drawing; but yet it is customary in this country and in England to place in working drawings these shade lines in such contradictory positions; and of course we must follow this custom, or else appear in an unpleasant position. We should also keep in mind, that since, in a drawing office, we must adopt this rule for placing the shade lines, instead of following the principles given in these papers, and since this rule does cover thoroughly every case, an advantage will be gained by knowing the definition of the shade lines and the principles given in these papers, as this knowledge will help us to overcome without any difficulty any doubtful cases which the rule does not cover. We believe in France the shade lines in working drawings are arranged in the same order as we have arranged them in our figures, and shall continue to do in the following figures and examples of working drawings. In brief, the difference which does and will exist between the arrangement of shade lines in our figures in these papers and the arrangement of shade lines in ordinary working drawings will only be found in the horizontal lines representing edges of plane surfaces in the plans or horizontal projections; and the difference is this, that in our figures the upper edges of plane surfaces are represented by shade lines, whereas in working drawings the lower edges of the same surfaces are represented by shade lines. No difference exists in the vertical shade lines, or in the arrangement of shade lines in any of the elevations or vertical projections.

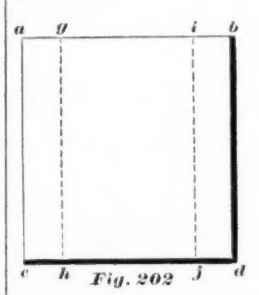


Fig. 202

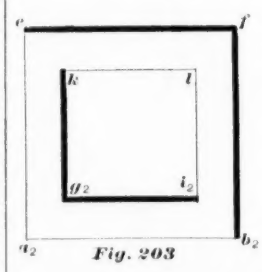


Fig. 203

ADVANTAGES OF SHADE LINES.

285. In article 268 it has been stated that a drawing with shade lines can be more readily read than a drawing without shade lines. Let us examine a few figures and see in what way shade lines will assist us in reading a drawing, and thus determine the value and advantages of shade lines. By studying this subject carefully, the student will also obtain an additional benefit, and that is, he will become more familiar with the reading of a drawing, enabling him to interpret correctly that which the drawing represents.

Fig. 202 represents a vertical projection, and Fig. 203 a horizontal projection, of a hollow prism, or, as the mechanic would say, Fig. 202 represents an elevation, and Fig. 203 a plan of a hollow column. Now suppose that only one view of this object is given to us, say the vertical projection, such as shown in Fig. 202.

Of course, with only one view before us, it would be impossible to say exactly what kind of an object is here represented, since at least two views are absolutely necessary to convey a correct idea of the complete form of any object (see Art. 209), but when the shade lines are used as in this figure, and we remember the definition of shade lines, then we may feel reasonably certain that because *b d* is a shade line that this figure does not represent a cylinder. Furthermore, when we consider the relative positions of the shade lines *b d* and *c d*, we also feel certain that this figure represents the elevation of the object, and not the plan. Hence, as meager as this information which the shade lines convey may appear, the shade lines have some value, for had all the lines been fine lines it would have been impossible to say that this drawing did not represent a cylinder; the value of this information will be found to be still greater when we attempt to read quickly a complicated drawing, because the shade lines may often obviate the necessity of frequently glancing from the elevation to the plan, or from one view to another in order to discern the true meaning of the drawing. But now suppose that only the plan, as shown in Fig. 203, is given to us, and not the elevation: here we see at once by the arrangement of shade lines that this drawing is the plan or horizontal projection of some object; and the shade lines further indicate that this object is either hollow or has a recess, but in order to determine which of these two the shade lines does indicate, we must also have the elevation, which in this case shows by the dotted lines *g h* and *i j* (Fig. 202) that a hollow prism is here represented. If the lines *k* g_2, g_2 i_2 had indicated a recess, then the dotted lines *g h* and *i j* in Fig. 202 would not have been drawn the whole length of the prism, but would have been equal in length to the depth of the recess. If no shade lines had been used in Fig. 203 it would be impossible for any one to decide, without having another view of the same object, whether this figure is a plan or not, or whether the lines *k* g_2, g_2 i_2, i_2 *l* and *k l* represent a recess or a something projecting beyond something else.

286. Now let us examine Figs. 204 and

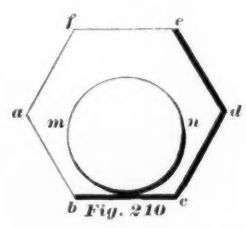


Fig. 210

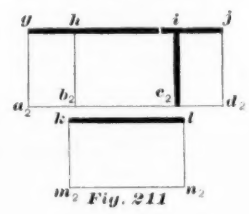


Fig. 211

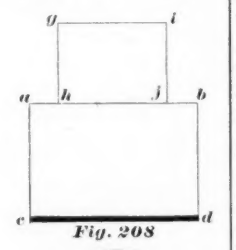


Fig. 208

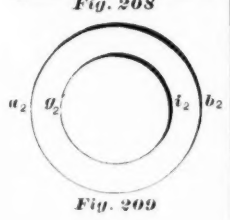


Fig. 209

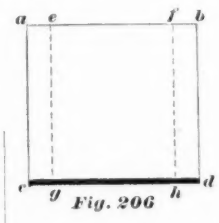


Fig. 206

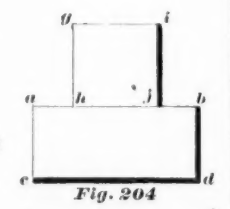


Fig. 204

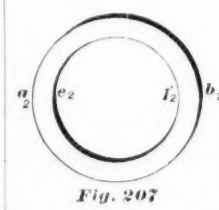


Fig. 207

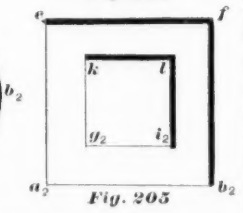


Fig. 205

205. The former figure is a vertical projection, and the latter figure a horizontal projection of two prisms, one standing on top of the other. Suppose only one view is given, say the plan, Fig. 205. Here, by the arrangement of the shade lines, we again notice that this figure represents a plan of some object or objects, and the shade lines *k l* and *l* i_2 indicate that something projects from or stands on some other surface. If now, in addition to the plan, we have an elevation given, such as shown in Fig. 204, we then see how far that which is represented by the square g_2 i_2 *k l* in Fig. 205 projects beyond the surface a_2 b_2 *e f*, or beyond the line *a b* in Fig. 204. Our principal object in introducing Figs. 204 and 205 is simply to enable us to make a comparison between the arrangement of the shade lines in Fig. 205 and the arrangement of shade lines in Fig. 203, and thus enable us to show the order of placing the shade lines when a recess or hollow object is to be indicated, as in Fig 203; and also show the order of placing the shade lines when a projection is to be represented, as in Fig. 205. The student should study the positions of the shade lines in Figs. 205 and 203 very carefully, and satisfy himself that these are correctly placed, according to the definitions of shade lines and principles previously given. He should also be able to give reasons why the arrangement of the shade lines in Figs. 205 and 203 represent plans, and how these shade lines should be placed, if Figs 205 and 203 had represented elevations or vertical projections of objects.

287. It must be remarked here that Figs. 204 and 205 are not quite satisfactory as working drawings, because the line *a b* in Fig. 204 throws us in doubt in regards to that which is here represented, as the line *a b* may represent two things, namely, a joint between two objects and at the same time an edge of one of the objects, consequently we cannot tell by these figures whether one or two solids are shown. How this doubt can be removed will be shown hereafter.

288. Now observe Fig. 206; here, because the line *b d* is a fine line, we at once conclude that a curved surface is represented, and as for the dotted lines *e g* and *f h* we cannot tell what these lines indicate, but as soon as the plan shown in Fig. 207 is given in connection with the elevation (Fig. 206) we know at once that a hollow cylinder is represented. Notice in particular the position of the circular shade lines in Fig. 207, and remember that the inner circle represents a recess or a hole straight through the cylinder, and the outside circle represents the bounding surface of the cylinder, hence the circular shade line on the inner circle must be opposite to the circular shade line on the outer circle. If in these figures no shade lines had been used, then by looking at Fig. 206 alone we could not tell whether this figure represented a prism or cylinder; and in looking at Fig. 207 alone it would be impossible to tell, in the absence of shade lines, whether the inner circle represented a recess or a projection; of course with both views before us it would then be seen that a hollow cylinder is represented. If a cylinder above another cylinder is shown, as in Figs. 208 and 209, then the circular shade lines in the plan must be placed as shown in Fig. 209.

289. Notice also the shade lines in Figs. 210 and 211, which represent a hexagonal prism with a cylinder in front of it. Notice in particular the arrangement of the shade lines around the hexagon, and compare with the arrangement of the shade lines around the hexagon in Fig. 199, and remember that Fig. 210 is a vertical projection and Fig. 199 a horizontal projection, and therefore the arrangements of shade lines must differ, and placed as shown in these figures. And lastly also notice circular shade line in Fig. 210, and compare it with the shade line in Fig. 201 and note the difference in position, which is caused by the former being a vertical projection and the later a horizontal projection.

Changes at Sibley College.

At a recent meeting of the Board of Trustees of the Cornell University, some important changes were made, on recommendation of the director, Dr. Thurston, in the faculty of the Sibley College. Mr. Frank van Vleck, the author of the set of conventional section linings recently published in the American Machinist, as adopted by the Sibley College faculty, and who was formerly an instructor in the mechanical laboratory and assistant to the director, has now been promoted to the assistant professorship of Industrial Drawing, and assigned to that department, and entrusted, also, with the direction of the post-graduate instruction in locomotive and railroad mechanical engineering. Mr. Albert W. Smith, also a member of the American Society of Mechanical Engineers, is appointed assistant professor of mechanical engineering, and assigned to duty as assistant in charge of the mechanical laboratory, as assistant to the director and as manager of the course of post-graduate study in steam engineering. Mr. Smith is a graduate of Cornell in the class of '78, and has since been employed in several establishments, at one time being the superintendent for the

Straight Line Engine Company, with Professor Sweet, on whose recommendation he was admitted to advanced work in the Sibley College, giving him a master's degree. He held a fellowship last year, and assumes important duties with his new appointment.

Shot Guns as Train Preservers.

The *Railroad Gazette* makes the following suggestion. It is full of good sound common sense. The only addition we could suggest would be to place a couple of the same kind of guns in every passenger coach, to be used in emergencies only, like the arrangement for applying the automatic brake:

The frequency with which trains have been "held up" lately in the Southwest by highwaymen suggests the necessity of measures for protection other than reliance on the local officers of the law. The good old-fashioned precaution of a double-barreled shotgun, here and there, handy for the trainmen to get at, would discourage the "agents" amazingly. About every tenth American male of middle age has at some time in his life ridden through the Port Neuf canon (or some other) with a shotgun on his knees ready for the "road agents." Is it possible that the ability to take care of oneself is passing away with the stage coaches? A couple of short, heavy double-barreled shotguns in the cab, and two or three more in the baggage and express cars, would stop the train robberies in short order. The "James boys" and their kind thoroughly dislike buckshot. Revolvers have little terror for them, but they can't stand the thought of being filled up with buckshot.

Chats with Foundrymen.

BY ROBERT E. MASTERS.

Last winter there was a discussion in the AMERICAN MACHINIST on steam *versus* stoves, for heating foundries. Mr. David Spence stated he understood that the W. F. and John Barnes Company, of Rockford, Ill., heated their foundry by steam. It is not my intention to open that discussion, as no doubt the boys get all the heat they want just now, without the assistance of either, and are more likely to look for a cool spot about the foundry.

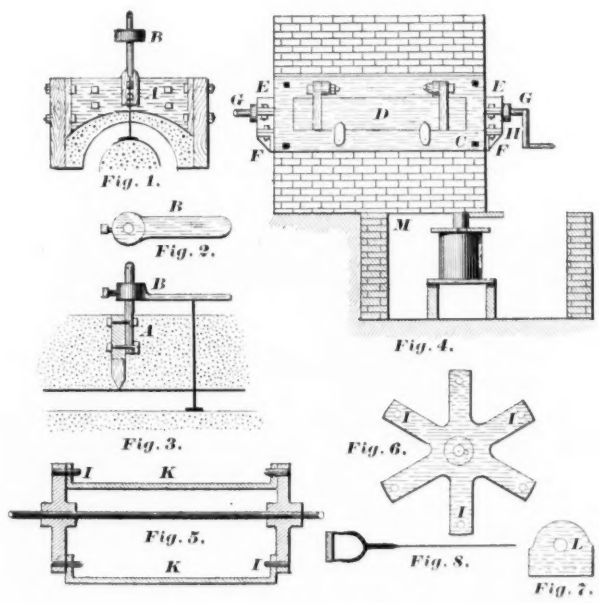
I once visited the above named establishment, and was shown through the works by Superintendent Barnes. Their foundry is a model of neatness and convenience, and as near the modern idea of what a foundry ought to be as one can well imagine. They have a perfect system of light, ventilation and over-head steam heating. The comfort and health of the men was taken into consideration in the construction of the buildings, as much as getting out the work advantageously. The same can be said of the other departments.

I noticed in the foundry a handy arrangement for fastening down chaplets on cores in special work. A piece of round iron, flattened at one end, is bolted to the iron cross bar *A A*, Figs. 1 and 3; and a set collar, *B B*, with a stem about 6″ long (Fig. 2), is let down on the chaplet, and screwed fast. In a regular class of work, this plan, which is fully explained by the drawings, saves the time of clamping, wedging or weighting down a chaplet.

At the Racine (Wis.) Hardware Company's Foundry, they employ a large number of moulders on bench work, turning out the finest class of small castings indicated by the name of the firm. In coversation with Mr. E. L. Ellsworth, foreman of the foundry, he said they use litharge match, or follow-boards, to a great extent, because they gave better satisfaction, and were cheaper in the end. He willingly gave me the formula for making them, for the benefit of the readers of the AMERICAN MACHINIST.

Take new, dry moulding sand, mix one-twentieth part litharge, one-twentieth part flour; temper with boiled linseed oil, the same as with water, for moulding.

In a good-sized country foundry, in an adjoining State, I discovered a core oven, which, with a little improvement, could be used to advantage in many shops that at present use most anything as a substitute for a core oven. Fig. 4 is a front elevation of the oven, with section view of fire pit. *C* is a cast-iron frame, with a sheet-iron door, *D*; the pillow blocks *E E* are bolted to brackets *F F*. The shaft *G* has a ratchet on it at *H*, with pawls fastened to the pillow block. Fig. 5 shows a section of the arrangement inside of the oven. There is a spider, Fig. 6, 4 feet diameter, with wrought-iron pins, *I I*, cast in the end of each arm, for the plates *K K* to swing on, which are keyed at each end of the shaft. Fig. 7 is an end view of the plates, for drying the cores on. The hole *L* is large enough to fit loosely over the pins, so that when the shaft is revolved by the crank to bring the plates on a level with the door to take out or put in the cores they will keep the position shown in Fig. 7. The oven was built against the back wall inside the foundry. It is 5 feet long, 6 feet high and 6 feet deep, for heating. A cylinder (with a boiler-iron door on it) made from a pulley band, was set on some grate bars in a pit under one corner of the oven, an opening inside of the oven above the stove and back to the wall *M* admitting the heat. The stove-pipe in the corner of the oven reached to the top and extended across the top, inside of the oven and out through the back wall, so that the oven was free from soot and smoke, and the cores were nice and clean. I have since seen an oven on a plan something similar to this operated by a crank from the outside, and a set of gears inside of the oven between the spider and the wall.



FOUNDRY DEVICES.

Fig. 8 will show the use made of old shovel handles in several shops I visited in the Northwest; they were sawed off within 6″ inches of the handle, a vent wire put in them and used for deep venting.

If "I. E. M.," who asks at the close of an article for information in regard to flasks for making pulleys on a machine will write to B. Lyman, of the Pneumatic Company, Indianapolis, Ind., manufacturers of rotary moulding machines operated by compressed air, I think he will obtain the needed information.

I feel very thankful for the kindly hand that was reached forth to help us out of the old rut, and enlighten us on gating car wheels and the use of chilled tools.

Mr. Hollister, foreman of the Ramapo wheel foundry, tells me they pour their wheels with three gates in a row; the center gate goes through the core to the bottom of the hub, and the two side gates are on top of the hub. After pouring a wheel the iron in the hub is churned a little through one of the side gates. There are a few other firms who practice this plan, and I believe there is no one who will question the experience or ability of the Ramapo Company to produce a good wheel. There are a number of ways of gating car wheels employed by different manufacturers, each hoping to get the best results, but the majority (ourselves among the number) now pour their wheels from the top of the hub and churn each one of them a little while. Car wheels may be poured without any gate on the hub, "and get a clean, smooth hub on both sides of the wheel every time;" but I doubt about the hub being solid; at least I have never found one solid that was made in that manner, and I have broken a good many.

Nearly all railroad shops, and most all car manufacturing companies, use steel cutters to bore out car wheels, but the chill cutter suggested by our generous friend is an economical and excellent plan on some work. They are used in the Roanoke Car Shops as a roughing cutter but for finishing they use steel cutters. Chilled tools have been in use for some time, and a detailed account with illustrations of "making chilled tools and tool chills," is contained in the AMERICAN MACHINIST of September 8th, 1883.

American Railway Master Mechanics Association.

REPORT OF THE COMMITTEE ON CYLINDER PACKING FOR 1887.

To the American Railway Master Mechanics Association:

The committee of research to whom was referred the subject of cylinder packing, beg leave to offer the subjoined report.

A series of inquiries embracing some of the important points bearing upon the question, were prepared by the committee and sent to the members by the Secretary, replies were received from the following named persons. [Here follows the names of 22 members who had replied to the inquiries.]

To the first question: Do you use cast-iron for packing rings? all reply in the affirmative; four report using what is known as Dunbar's packing; eighteen report using cast-iron rings cut in one place only.

To the second and third questions: What width and what thickness are rings when first applied? a diversity of answers were received: Four report using rings $\frac{3}{4}$″ wide and $\frac{7}{8}$″ thick; three are using rings $\frac{3}{4}$″ wide and $\frac{5}{8}$″ thick; two use the Dunbar packing $\frac{3}{4}$″ wide; one uses Dunbar packing $\frac{7}{8}$″ wide; one uses Dunbar packing 1″ thick; one uses rings $\frac{3}{4}$″ wide and $\frac{9}{16}$″ thick; two use rings $\frac{3}{4}$″ wide and $\frac{3}{4}$″ thick; two use rings $\frac{1}{2}$″ wide and $\frac{1}{2}$″ thick; one reports using rings $\frac{9}{16}$″ wide and $\frac{9}{16}$″ thick; one reports using rings $\frac{7}{8}$″ wide and $\frac{3}{4}$″ thick; one uses rings 1″ wide and $\frac{3}{4}$″ thick; one uses rings $\frac{7}{8}$″ wide and $\frac{7}{8}$″ thick; one uses $\frac{5}{8}$″ by $\frac{5}{8}$″; one $\frac{7}{8}$″ by $\frac{1}{16}$″.

To the fourth question: How much larger than the cylinder are the rings when first put in? there is a difference in sizes given. Two say $\frac{3}{8}$″; one says $\frac{5}{16}$″; four say $\frac{1}{4}$″; four say $\frac{3}{16}$″; one says $\frac{1}{8}$″; four say $\frac{1}{16}$″. All reports vary the amount according to the sizes of the cylinder. Those who are using the Dunbar packing report making same to the size of a cylinder; two give no statement as to how much larger, if any, the rings are made.

To the fifth question: Do you, after turning up the rings, cut them, spring them in and true them up to the correct sizes of the cylinder? eighteen say they do not; four say they do.

To the sixth question: Are rings made heavier opposite to where they are cut? seventeen reply no; six say yes.

To the seventh question: What is your usual plan for breaking joints? the replies indicate a variety of plans. Mr. J. Davis Barnett reports that his usual plan is to have the two rings break joints at 90 degrees from each other, each being held in place by $\frac{3}{8}$″ dowel pins screwed radially into the piston head 45 degrees from the bottom of the cylinder.

Mr. H. Schlacks reports that originally his plan was to place both openings on the bottom of the cylinder, making the joint with the tee ring, which by this method formed a perfectly tight joint; experience indicated that this practice caused a ridge to be worn throughout the entire length of the cylinder, between the openings in the rings, and he has now adopted the plan of having the two rings break joints at 90 degrees from each other, each being held in place by a $\frac{3}{8}$″ dowel inserted into the tee ring 45 degrees from the bottom; with this arrangement the cylinders wear somewhat oval but perfectly smooth.

Mr. J. N. Lauder mills away part of one side of the packing ring, and rivets one thin piece of iron, as shown on blue print.

Mr. C. C. Hobart also mills away part of one side of packing ring, as shown on blue print.

Mr. John Player cuts the rings diagonally across, as shown on blue print. Three members report having the ends of the rings lap half and half. Seven members report using dowel pins, placed near the bottom of tee ring, and inserted into it.

To the eighth question: Do you use springs to assist in setting out the packing, or depend upon the elasticity of the rings, assisted by steam? eighteen report that no springs are used; and only those who use the Dunbar packing say that springs are used, although one member suggests that he thinks that the use of springs would be a good practice. From these it is evident that springs are not necessary.

To the ninth question: Are more than two rings used in one cylinder? twenty-one members report only two being used. Mr. John S. Coe reports that he uses three rings in all of his solid piston heads.

To the tenth question: Have you tried steel, bronze, or gun-metal? and if so, state results, Mr. J. Davis Barnett reports having tried three wrought-iron rings in each piston, $\frac{5}{16}$″ wide by $\frac{3}{8}$″ deep, under the Ramsbottom patent; they did their work well, but did not last as long nor keep as tight as cast-iron rings of stouter section. Others report formerly using brass or gun-metal; but the frequent adjustment required caused the use of them to be discontinued.

To the eleventh question: Do you use any patented style of packing ring? four report the use of the style generally known as Dunbar's, which has been in use for the past eighteen years. No other style of patent ring is mentioned; and the general use of a cast-iron ring, cut in one place only, and held in contact with the walls of the cylinder by its own elasticity, is indicated by a large majority of the reports, viz., thirteen out of twenty-two.

To the twelfth question: Do you use solid heads or spider follower and tee ring? five say they use and prefer solid heads; seventeen use spider follower and tee ring. Mr. John S. Cook reports that he uses solid heads with three grooves $\frac{1}{2}$″ wide, and holds the piston centrally by means of brass bushes placed in the stuffing boxes, and which are renewed as often as necessary. Mr. James Meehan reports that he uses solid heads and springs the rings into grooves; he thinks they are preferable to spider heads, and cheaper. Mr. Schlacks

reports that some twelve years ago he commenced using solid cast-iron heads 4½″ thick, the packing rings being sprung over the head into grooves. He has obtained excellent results from it, and prefers it to the spider and follower. 1. Because there is no danger of the follower bolts working loose, causing the breaking of the cylinder or cylinder head. 2. It is 50 pounds lighter, that is, 140 pounds against 190 pounds. 3. It can be fitted up at one-half of the expense of the spider and follower, and is less expensive to maintain when it is well designed and cored out, and the walls properly secured by stay bolts tapped through the head; there is no danger of its failing while on the road, as in our entire experience we have not had one give out. On account of the gases which appear to collect in the cavity made by the core we have found it necessary to drill a $\frac{3}{16}$″ vent hole through the wall on one side of the head. Mr. E. I. Weisgerber states: For the past five years we have been using a solid cast-iron head because it can be fitted up for one-half the cost of spider and follower head, and there is no liability of the follower bolts working out and causing the breakage of cylinder heads and cylinders. Mr. J. Davis Barnett says: We use solid heads and spring the rings over into grooves; would recommend a solid piston head, that is, a head cast completely in one piece, as, if properly designed and cored out, it can be made as light in weight as a spider head at one quarter its cost; there is less risk of failure in a solid head when it is out on the road at its work, and being cheaper to renew, there is less reluctance felt, when the head is worn, in throwing it away and putting a new one in.

To the thirteenth question: What is your general practice for adjusting the piston in the center of the cylinder? in all reports in which a spider follower and ring is reported to be used members say they turn out the tee ring larger than the arms of spider and line up the piston centrally by means of sheet-iron shims placed under the bottom arms, and hold the tee ring in place by clamping it with the follower.

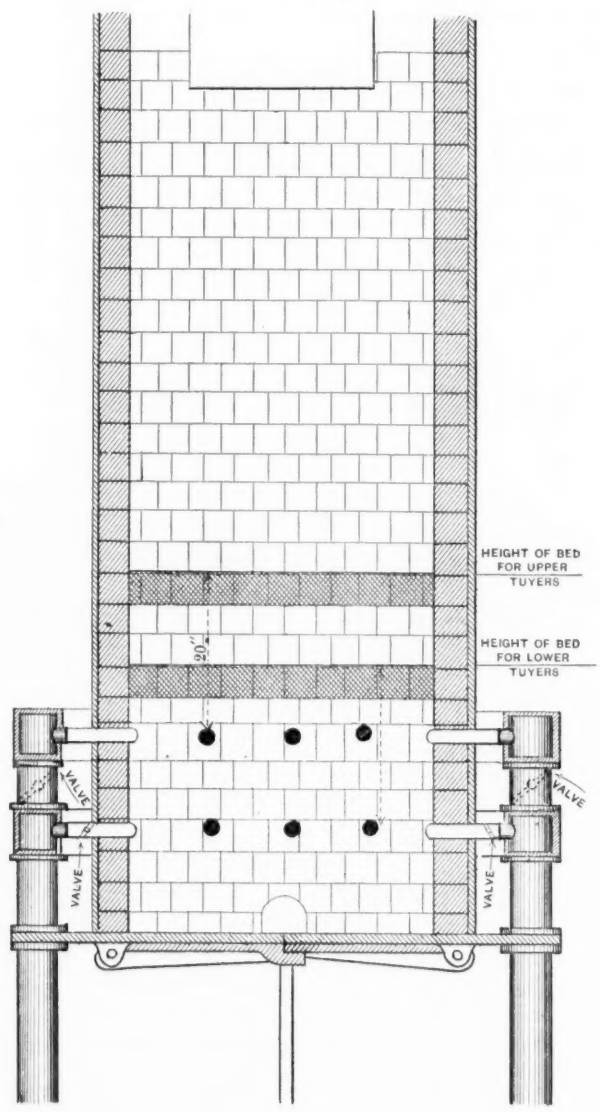
To the fourteenth question: Do you drill small holes in the piston to set out the packing? all reply no.

To the fifteenth question: How much side shake do you allow? twelve report slight side shake as being necessary to prevent rings from sticking with gum from lubricant; ten members report that no shake is allowed.

To the sixteenth question—which is the most important on the list—what is your observation as to the wear of cylinders with cast-iron rings as compared with the old style of brass packing? the replies are very full. Mr. Davis Barnett says: Steam packing did badly bell-mouth the cylinders at each end, and cast-iron rings sprung into place have the same tendency, but in a very mild form, so that this defect is the slightest disadvantage yet experienced with any known style of piston packing. Cylinders will run from 150,000 to 200,000 miles without reboring, but I would recommend a very light cut to be taken at every 100,000 miles, as this practice, while reducing the cylinder friction, will not reduce the thickness of the cylinder shell as much as a heavier cut taken at dates further apart. Mr. J. N. Lauder says: My observation is, that when steam is let under the rings the wear of the cylinder is much greater at the ends than at the center, and I try to exclude the steam as much as possible, but steam will go in at the cut to some extent. Mr. Thomas B. Twombly states: Cylinders wear out much faster with the old brass packing than with the steam packing. In using steam packing we notice that the cylinders are worn away a great deal more rapidly near the ends, but the packing seems to remain tight, and I do not regard this irregularity as a serious disadvantage. I do not think it necessary to rebore cylinders at any regular periods, but when an engine is in for repairs her cylinders should be inspected, and if worn so much that they are no longer capable of rendering good service, should be rebored. We have many cylinders ten years old which have not yet been rebored. Mr. G. H. Prescott says that with steam packing, cylinders wear most at each end and at the bottom. Mr. H. Schlacks reports that in his observations steam packing wears the cylinders more at the ends than in the center, but while he considers this irregularity a disadvantage, experiments have demonstrated that the packing remains tight throughout the entire travel of the piston. Boring depends upon the quality of the metal in the cylinder. Cylinders usually run about 175,000 miles before reboring is found to be necessary.

Mr. John Player says: With our packing the cylinders were good, and show as even wear from end to end of piston travel. Cylinders need reboring about once in six or seven years, or say after running about 250,000 miles. Mr. A. Griggs states: I find the spring ring packing to be of great advantage over the old style of brass spring packing: 1. Because it costs but one-fourth as much. 2. Because it is automatic, requiring no springs to set it out. 3. Because it does not require looking at on an average once a year. 4. When properly fitted up it will run on an average five to six years without renewing, and wear the cylinders comparatively true, showing in that time a difference of not more than $\frac{1}{16}$″ in diameter at the ends and center. Cylinders made of good hard iron will run ten years without reboring, being counterbored once during that time. C. C. Hobart states: The wear with us is very even—a trifle more, perhaps, at the ends than at the center of cylinder, due more to pressure of steam than other cause. Mr. E. I. Weisgerber says: There is less wear with the steam than with the spring packing, from the fact that cylinders are not so liable to get cut, as the rings are free in the cylinder when steam is shut off. We find that cylinders are worn more at the ends, but do not consider this any disadvantage, for the reason that the rings are flexible and adjust themselves to irregularities of the cylinders. Cylinders in which steam packing is used require reboring about every four years. Mr. James Meehan says: I think better results are obtained from the present style of steam packing. I have not noticed the cylinders wearing any more rapidly than with other packing. Boring depends upon the quality of the metal in the cylinder. Mr. John S. Cook says: With the cast-iron packing we use, we find our cylinders wear less than with the old style brass ring packing. Mr. W. H. Thomas reports: Where steam packing is used the cylinders wear largest at the ends, more so than by the use of the old style brass packing with springs; I do not consider this irregularity in the diameter any disadvantage in a packing which is flexible and automatic in its adjustment. Reboring is necessary about once in five years. Mr. G. W. Ettinger says: Steam packing wears the cylinders less, but not so regularly as the old style brass packing. Mr. F. C. Ennis says: Cylinders wear faster at the ends than with spring packing, but I think with us very little, as we do not rebore cylinders oftener than once in three years on an average, and our mileage on a heavily graded road averages 2,650 miles per month per engine. Mr. John W. McKenzie says: Cylinders are worn more at ends, but I do not regard this as a disadvantage with proper lubrication. We rebore about every 100,000 miles. Mr. John McGrayel says: This style of packing wears a cylinder out of round faster than the old style spring packing or Dunbar, but is much cheaper in first cost and maintenance. Mr. W. H. Stearnes says: Wears most at ends, but gives very little trouble. Cylinders run from eight to ten years. The grade of iron preferred for use in packing rings is very similar in all reports; a preference for a tough, elastic and not too hard metal being expressed; some think the ring should be softer than the cylinder, so that the greatest wear will be upon the ring, rather than the cylinder.

Your committee lay these views before you, as reported to them by members from various parts of the country, whose statements indicate that the use of narrow cast-iron rings, cut only in one place, and which adjust themselves to the walls of the cylinder by their elasticity alone, or by that and as much steam as may leak under the ring through a sliding or a slightly loose ring, have displaced other forms of packing rings; and while the reports also indicate that the cylinders are worn more rapidly at the ends than at the center, by the use of these narrow rings, than was the case with such packing as members used formerly, their great cheapness, and long wear with little attention, have brought them into almost exclusive use, as a durable and economical appliance. The reports received from members were very full and instructive; and while the committee have sought to present the information in a form greatly condensed, they trust that enough has been shown to provoke discussion, and only regret that any abridgment was necessary.



Foundry Cupola.

LETTERS FROM PRACTICAL MEN.

Foundry Cupolas.

Editor American Machinist:

Regarding the matter which you refer to me as to raising the tuyeres in a cupola to increase the capacity of the cupola so that more melted iron could be held before tapping out, it is very often done. But if the heavy pieces of 7,000 pounds or 8,000 pounds are exceptional, it would mean excessive consumption of fuel for regular work unless the arrangement was made so as to be easily changed, from high to low tuyeres. If the cupola is of sufficient size, say 38″ or 40″ inside of lining, there should be no trouble in pouring a casting of the above named weight, if the metal is taken care of after it is melted and tapped out, even with tuyeres so low that but 1,200 or 1,800 pounds only can be obtained at a tap.

The writer has cast some large pieces, 3 and 4 tons, when but 800 pounds would fill cupola to the tuyeres. To keep the iron in the ladle hot and liquid, a liberal quantity of charcoal, dry sand or sawdust was put in the ladle, and it had a good hot fire around the outside or was banked up with dry sand on outside, while being filled and until ready to pour. To handle 6,000 or 7,000 pounds of iron when cupola capacity is small, tuyeres low, etc., means careful attention and considerable nursing, but it can be done, and if the need is but occasional it is more on the side of economy to take care of it as above mentioned after it is melted than to make a permanent change in height of the tuyeres.

The writer recently designed a cupola for just the conditions spoken of, as shown in sketch herewith. For anyone starting in the business, and having but one cupola, by the arrangement of wind boxes, as shown, one above the other, and connected with pipes, with a valve in them and valves in the lower row of tuyeres, it would be a few minutes' work to change from high to low tuyeres or vice versa—plugging up those not wanted.

As has been often mentioned, and is generally known the bed (so-called) has got to be a certain height above the point of wind entrance, about 20″ varying as per force of wind, low pressure, low bed. You will see by sketch that the quantity of fuel for bed will be, as capacity of cupola is increased, below the point of wind entrance.

A great many melters don't prepare the cupola properly. They will insist on taking a rammer into the cupola when putting in the sand bottom, and pound the sand so hard that you can hear the blows all over the shop. The writer has seen a melter stop up every hole and aperture with clay, and then ram in bottom as above and have a run out in the bottom, and the tuyeres close up (bunged up) before 4,000 pounds of iron were melted in a 10 ton heat. The foreman upbraided the melter, claiming he could not have stopped up all the holes with the clay or it would not have run out, etc. The fact is, every cupola bottom should have a liberal supply of ½″ holes properly placed for the purpose of permitting the steam to escape. The bottom in a cupola should be so soft and porous that the melted iron will lay quiet, as it should in a mould. Every moulder knows, or should know, that if the metal does not remain quiet in the

mould while being filled the casting will be dirty and stoggy. The old way of refining iron was to boil it, by which the impurities are thrown out, and if done in the cupola by agitation before tapping, the dross and cinders cling to the fuel that is coldest (next the tuyeres); and by gracious, here's another piece of hard luck. She's bunged up "again," and the boys go fishing "again" and "again," and yet this is no uncommon occurrence or exaggeration. A prominent blast furnace man once informed the writer that a blast furnace was an invalid—"always something ailing"—and so it is with the foundry cupola if not run right, and in accord with common sense.

FOUNDRYMAN.

Shop Kinks.

Editor American Machinist:

We have one of Sellers' large boring mills on which we have to bore out all our tires for driving wheels, and also all our car wheels, tender and forward truck wheels. Often we find it necessary to square off the hubs of wheels or pulleys, and we had either to change the boring bar or else square the wheels off on the axles. Both ways caused considerable trouble; and to get over it we made a tool holder to slide over the bar, as shown in Figs. 1 and 2. *A* is a view of tool holder. When boring out wheels we slide the holder up on the bar out of the way, and when needed to square up the hub we slide it down on the bar over the cutter, a slot being cut in the holder for that purpose. Then put in a common turning tool and feed across. This finishes the wheel, the hole and hub being in line with each other. This saves once handling of wheels or pulleys, and saves time.

We also made a gauge for measuring the distance of hubs of wheels from the tread or gauge line, as shown in Fig. 3, applied to a wheel. We have found this a very good tool in getting the exact measure, and in calculating the lateral motion. This needs no explanation, as any mechanic can see the advantages of such a tool at a glance.

In pressing on wheels to get them exactly in true position we use a gauge, as shown in Fig. 4. This we also made here. We gauge from the center of the journal, and by using this method and this gauge we put on our wheels as near perfect as possible. You will notice we have the tread measure, also the inside flange measure, and the imperfections of old wheels whose journals crowd the jaws and grind out the ends of the brasses, and rail crowding is by the use of this gauge easily detected and put right. These tools we have found to be great labor saving as well as accurate measuring tools. On a road such as ours, hauling so much foreign freight, and doing repairs on so many different styles ofcars and wheels, they have proved of great value, and would be to any railroad repair shop.

WILLIAM FOSTER,
P. & W. R. R. Repair Shop,
Valley Falls, R. I.

Trouble With a Fire Pump.

Editor American Machinist:

A steam fire pump that I have charge of acts very strangely. The pump is located 425 feet distant and 17 above the supply of water. The suction pipe has foot valve and strainer, and I know this pipe is tight, having tested it under 80 pounds pressure. The water is forced from the pump into distributing pipes, which supply the hydrants. The pump will be working perfectly, when all at once it will lose the water, and away it goes; and sometimes we have to run it ten minutes before it will catch it again. Thought something might be in the suction pipe and get under the pump valves, and I put a fine wire cloth strainer in the pipe near the pump, but it does not cure it. I have stopped the pump at such times and carefully examined the valves and always found them well seated. Have tried soft rubber valves, and springs of different tension, but all to no purpose. Have given the pump valves different lift on their stems. Air is discharged with great force from the vent or air cock in the discharge, which I always open when the pump loses the water as stated above. Can any reader of the AMERICAN MACHINIST suggest the cause of my trouble?

ENGINEER.

Boiler Explosions.

The *Locomotive* of recent date refers to an article on boiler explosions as appearing in "one of our contemporaries." We admit the indefiniteness of this, but from the quotation that follows we are reasonably certain that the article in question first appeared in the AMERICAN MACHINIST. The *Locomotive* takes some one (we assume ourselves) to task for making the assertion that explosions of locomotive boilers are rare, considering the conditions under which they are used. We quote as follows:

There were twenty-two locomotive boiler explosions in this country in the year 1886; more than there were among any other class of boilers except saw mills and wood working establishments. We do not know how the total number of saw mills in the country compares with the number of locomotives, but we have the impression that such boilers outnumber locomotives largely. If such is the case, the ratio of explosions to boilers in use does not show much to the credit of the locomotive, especially when we take into account the greater facilities available for repairing locomotive boilers.

Now we do not pretend to be able to tell the comparative number of saw mill and locomotive boilers in the United States, but we venture a Yankee guess that our contemporary is woefully mistaken in its estimate. We acknowledge the superiority of its means of information, and simply ask it to revise its figures, agreeing to take its revision as conclusive. We have faith that this revision will materially modify its conclusion; in other words, that it will find a good many times more locomotive boilers in use than it will saw mill boilers. We do not say this is so, but shall be interested in the figures if our contemporary concludes to give them.

Our contemporary further says:

But we do not wish to convey the impression in this article, that we believe locomotive engineers are, as a class, inferior to other sorts of engineers. On the contrary, we will distinctly state it as our belief that they understand their business, as a rule, just as well as other classes of engineers understand theirs, and not one whit better.

In reply to this it is unnecessary to say that we never insinuated that there was not "other sorts of engineers" just as good as locomotive engineers. But there are literally thousands of men placed in charge of stationary boilers who have had no training to fit them for their duties; the same cannot be said of locomotive engineers, who, as we intimated, must have had some years' experience before they are allowed to take charge of boilers. These we believe are facts that cannot be successfully disputed, and they account, in our opinion, for what appears to be true, viz., that considering the conditions, explosions are rare in the case of locomotive boilers as compared with stationary boilers.

We could quote from our contemporary, if it were advisable, some very readable matter on the subject of incompetent stationary engineers, but it seems unnecessary.

There are mechanics of such ripe experience and activity of mind, that it does seem a pity somebody doesn't invent a recording machine capable of taking down and reporting their notable sayings. Information that would benefit mechanics everywhere should not be, so to speak, thrown away on two or three persons.

It is said that chemicals to the value of over $4,000,000 are used yearly in paper making in the United States.

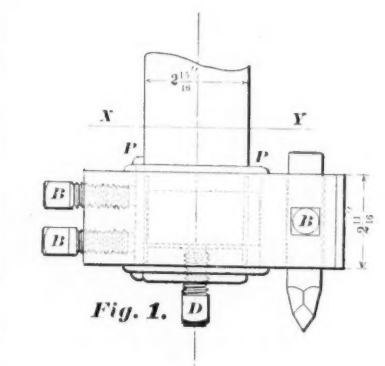
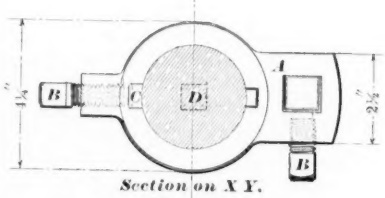


Fig. 1.



Section on X Y.

Fig. 2.

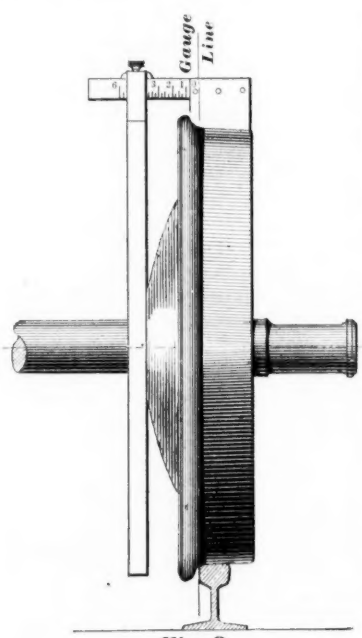


Fig. 3.

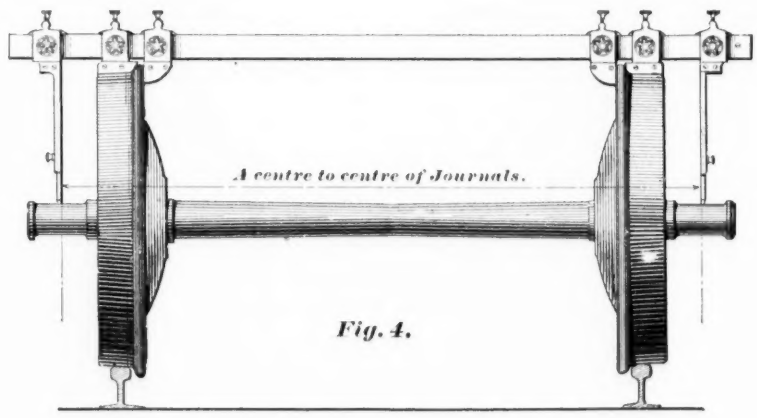


Fig. 4.

SHOP KINKS.

A builder in Newburgh, N. Y., who is tearing down a building to make room for a new one, is putting the old brick and mortar of the building to a novel use. He has contrived a grinding machine into which he feeds the old brick and mortar, and it is ground into powder, or rather into building sand and cement, and the material will be used in setting brick in the new building.

Is it Time to Slow Up?

A Philadelphia correspondent who has exceptional facilities for observing the condition of business in many lines of manufacture, and noting present and prospective tendencies, sends us a letter, which we print below. To us his view seems somewhat over-stated with respect to the inability of manufacturers to keep up with the existing demand, speaking with reference to the general list of industries. We should entertain a less cheerful view of the existing business situation, if we felt assured that our correspondent's view was fully warranted in these respects.

Then, too, as to the expediency of "enlarging manufacturing capacity," in the sense covered by our correspondent's letter, we are convinced that manufacturing establishments, speaking generally, lose more money in the long run, through over enlargement of manufacturing facilities, than they are likely to lose through having just a little too much capacity when business is bad and somewhat too little when business is good. Of course, the sort of enlargement of capacity which comes from better organization and improved methods is always in order. In that direction it is never necessary to "slow up," as our correspondent puts it, for the reason that it is precisely when business is bad, that the greatest proportionate benefit is derived therefrom. We append our correspondent's letter below:

Editor American Machinist:

The question which manufacturing interests generally would be glad to solve clearly at this time is: Will it be safe to expand manufacturing capacity to the extent that present requirements seem to call for? The relevancy of the inquiry is apparent, when we observe that seventy-five per cent of the manufacturing capacity of the country has business in hand or in sight, that will occupy that capacity from one month to six months. On the other hand, manufacturers cannot forget that it was but the other day when they were told, and, in fact, when they were inclined to believe that the country had manufacturing capacity enough to produce in six months what could be consumed in twelve months. Those who are well established are anxious to keep abreast of the times by expanding capacity, but while they hesitate, hundreds of new concerns are springing into existence, corporate and otherwise, to share with them in the phenomenal abundance of work. The rail makers are selling steel rails to be delivered next winter and spring. The bridge builders have placed contracts for material which will be delivered along until January. Machinery manufacturers are sold up for varying periods. Stocks of all kinds of material are light, and prices are firm. A slight swell in demand would crowd up asking prices in iron, steel, lumber, coal, cotton, wool and oil, and hence in their products. It is evident that there is a market for our entire present output. The limit may be as unexpectedly reached in the future as in the past. The controlling factors are, however, somewhat different. The volume of money is greater and the cornering of it is more difficult. The producing capacity of the country is larger and is under better control. Manufacturers' combinations are powerful and well organized, and distribution is controlled by the delicate but invisible machinery of weights and balances which make over-production next to impossible. Then, with the aid of modern facilities, bad places are avoided and credits are kept pretty sound. Yet, withal it is no easy question to decide whether this is the time to slow up. The general expansion in real estate values, and the great activity in building, coupled with a comparative freedom from debt of our vast manufacturing and producing interests, go to show that we have not yet reached the limits of a healthy expansion. It will be time to hesitate when extended credits are asked for, when goods begin to accumulate in warehouses and factories, when banks begin to call in their paper and hedge against borrowers, when railroad traffic declines and railroad construction falls off, and when business begins to cramp up from invisible but powerful causes. Yet, in expanding productive capacity, it is necessary to act with prudence.

X.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Pres't.
JACKSON BAILEY, Vice-Pres't.
LYCURGUS B. MOORE, Treas. and Sec'y.
96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

F. F. HEMENWAY, Mechanical Engineer.

The American News Company,
Publishers' Agents, New York.
The International News Company,
11 BOUVERIE STREET, Fleet Street, LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.

SUBSCRIPTION.

$2.50 a year in advance, postage prepaid in the United States and Canada.
$3.50 a year to Foreign Countries, postage prepaid.

ADVERTISING.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

EDITORIAL ANNOUNCEMENTS.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, JULY 16, 1887.

CONTENTS.

	PAGE
Multi-Tubular Expansion Boiler	1
Machine Tool Construction. By F.G. Woodward	1
Discussion of Topical Subjects at Master Mechanics' Association	2, 3
American Water-Works Association	3
Domes on Boilers By James Heron	3
Practical Drawing. By J. G. A. Meyer. Twenty-eighth Paper	4
Changes at Sibley College	4, 5
Shot Guns as Train Preservers	5
Chats with Foundrymen. By Robt. E. Masters.	5
American Railway Master Mechanics' Association	5, 6
Letters from Practical Men—Foundry Cupolas. By Foundryman—Shop Kinks. By William Foster—Trouble With a Fire Pump. By Engineer	6, 7
Boiler Explosions	7
Is it Time to Slow Up? By X.	7
Master Mechanics' Convention	8
Boiler Inspection and Boiler Insurance	8
Appreciating Mechanical Methods	8
Improving Through Freight Methods and Equipment	8
Literary Notes	8
Questions and Answers	8, 9
Manufactures	9
Machinists' Supplies and Iron	10

Master Mechanics' Convention.

The attendance at the twentieth convention of the American Master Mechanics' Association, which began at St. Paul, June 21, was greater than at any that have preceded it. The proceedings were also entered into with more than the usual interest. This is particularly true of matters brought up for discussion that had not passed the ordeal of a regular committee report.

The reports of committees were in the main very good indeed, and often quite exhaustive.

The secretary's report, showing a gain of 28 members since the previous meeting, also showed losses from resignation, from death, and from being dropped from the rolls, that nearly offset the gain; the total membership is 279.

The officers for the ensuing year are: President, J. H. Setchel; Vice-President, R. H. Briggs; Secretary, Angus Sinclair; Treasurer, Geo. Richards.

Boiler Inspection and Boiler Insurance.

We have previously urged the need of laws applying to stationary boilers throughout the country, the same kind of governmental supervision that is given to marine boilers, especially in view of the too prevalent practice of furnishing and accepting boilers made of inferior grades of iron and steel and according to unsafe methods, even in cases where the need and value of safe materials and methods had been fully recognized in the specifications. If unfit materials are put in a boiler through failure to follow the specifications, or for any reason, there is always more than one party to blame. The boiler owner cannot shirk his moral responsibility if he sets up a death-trap for the possible injury of others. If self-interest fails to prompt him to supplement ignorance on his own part with the opinion of a skilled mechanic, the law should do it for him, not for the sake of protecting his pocket, but to guard the lives that are put in jeopardy by his solicitude for his pocket. The same law that protects the boiler user and boiler owner would be found equally efficacious in protecting the interests of those boiler manufacturers who desire only to do good work, by holding in full view of their responsibility, the unscrupulous "competitors" who assure prospective purchasers that boilers made by them are safe, which they know, or ought to know, are not safe, and must become less safe with each year that passes.

As matters now stand, about the best defense the public have with respect to many of the boilers in use is the measure of protection afforded by companies whose business it is to insure boilers, for a given time, after inspection by and on the report of skilled and competent agents of their own. But if, in any instance, such a company should take the word of a manufacturer for the quality of the boiler built by him, and "insure" it without inspection, or assuming that it will not, according to the average run of chances, be likely to explode during the year, should insure it after inspection, knowing it to be faulty, the very end and aim of its existence, so far as the community is concerned, would be subverted.

Right here comes in a special difficulty. In too many cases, the boiler owner appears to act upon the assumption, that boiler insurance is merely a question of getting back so much money in case the boiler explodes. He often does not seem to think substantial evidence as to the sound condition of the boiler and watchful care as to ways and means of keeping it sound are of any special value. In other words, he is willing to pay for the insurance that protects his own pocket, but nothing for the inspection that protects the lives of others placed at risk by his default.

If, in view of these circumstances, boiler insurance inspectors and companies find themselves brought face to face with the temptation to exaggerate the fact of competition, let them not forget, that their responsibility has a moral as well as a business side. The theory of boiler insurance differs widely from that of either fire or life insurance, in this respect, that in both life and fire insurance the preliminary inspection made is made purely and wholly for the money protection of the insurance company. In boiler insurance the inspection on which it is based is made primarily to show the insurance company that the insurance policy can be issued, backed up as it will be by repeated after inspections, practically without money risk to the company, so far as the inherent qualities of the boiler itself are concerned. Of course there are other elements of risk, and these are the only ones the insurance company is morally at liberty to hazard. It has been urged by some, that boiler insurance companies should offer discriminating rates for varying risks; that is to say, the lower the grade of iron or steel or workmanship in the boiler insured, the higher the rate of insurance should be.

But this proposition leaves out of the account that the boiler insurance company, while it would be entirely justified in doing so, if nobody was concerned with it in the transaction other than the boiler owner, is really dealing with the public through the boiler owner, and has no right to sanction "risks" to the public, merely because it is willing to stake a money pledge on the result.

Boiler inspection and insurance have done much in the past to elevate the standard of quality in steam boilers. But the companies engaged in this business will only do full justice to themselves by doing full justice to the public, even to the extent of refusing to insure, when necessary for the protection of the public.

Appreciating Mechanical Methods.

A New York daily is very severe upon Mayor Hewitt for saying that he wants to consult with members of the American Society of Civil Engineers and the American Society of Mechanical Engineers, before giving his sanction to the report of a commission appointed to consider the subject of widening Elm street, in order to relieve Broadway. It asks in effect: What do mechanical engineers know about widening streets, anyway?

The kind of mechanical engineers the Mayor would be likely to call on for advice in such a matter are men specially trained to deal with ascertained physical forces in an exact and comprehensive way, and they would be little likely to advise the spending of millions to free Broadway of jams, without considering very carefully whether the proposed improvement would relieve the jam where it is greatest, as well as where it is lightest. Mayor Hewitt has all his life been associating with mechanics, and in this instance seems to appreciate their ways of thinking. The Mayor's business head is mechanically level.

Improving Through-Freight Methods and Equipment.

A mechanical engineer, who is brought into close contact with officials of leading railroads, believes that, largely as a result of the workings of several provisions of the Inter-State Commerce Law, and especially that abolishing freight pools, the tendency of the future in trunk line railroad matters will be towards systematizing and greatly extending existing facilities for making through shipments of expensive merchandise. Obviously this would mean carrying such goods in much less time than can now be relied upon, and without the exaction of greatly increased rates. His view is, that hereafter the competition existing among such roads will be less in the direction of rate-cutting, and more in the direction of offering superior facilities to customers.

To apply such a system, in conjunction with the requirements for other kinds of traffic, would in great part require cars and possibly locomotives specially built for the purpose, made up into short trains devoted wholly to such freight, and moved in accordance with time tables providing for substantially as steady running as is the case with passenger trains. In fact, the belief is expressed that such trains could, as a result of improved construction and equipment and proper organization, be run successfully as "second sections" of the slower passenger trains. Whether this latter expectation is realized or not, the attempt would mean the application to freight traffic of through lines (with view to saving time on shipments of high-cost goods on which even a few days' loss of interest and use of capital is important) of principles long since applied to passenger traffic, with respect to speed, as well as comfort. Any degree of improvement in that direction would seem to be in accord with the tendency of the times, as exemplified in other departments of progress.

Literary Notes.

We are pleased to note that Henri Gerard has become the publisher and proprietor of the *Manufacturer and Builder*, of New York, after a business connection with it of fifteen years. The paper is now in its nineteenth year, and it is Mr. Gerard's purpose to improve it, and add new features from time to time. Our acquaintance with him leads us to the belief that the journal in question will improve under Mr. Gerard's management.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(294) We advise A. J., Salem, Mass., who asks how he should secure a patent on an invention of his, to apply to a regular patent attorney. There are plenty of them in his vicinity—in Boston, for instance.

(295) C. E. C., Boston, Mass., asks: What is the best substance for filling the sunken letters of brass checks—something easily applied, and still durable? *A.*—We do not know of anything better than asphaltum. This can be melted, the cavities filled, and then the surface polished.

(296) C. H., Fort Wayne, Ind., writes: In a book which I have I find standard pipe threads given as follows: ⅛—28—¼ and ⅜—19—1, 1¼ and 1½—11. These are given differently in the AMERICAN MACHINIST of March 19. Which is right? *A.*—The threads, as given in the AMERICAN MACHINIST of March 19, are standard.

(297) J. S. L., Allentown, Pa., asks: How large a stack must I have, and what should be its construction, for seven boilers, each 100 horse-power? *A.*—For size of chimney see table in AMERICAN MACHINIST of April 23, 1887. For construction see AMERICAN MACHINIST March 18, 1882, March 24 and May 19, 1883, and March 27, 1886.

(298) F. K. H., Minneapolis, Minn., writes: Will you please let me know how the decision of the U. S. Supreme Court in the driven well case is going to effect users of these wells? Will the Drive Company commence to collect royalties again? *A.*—As we understand this decision, the company is entitled to royalty on all driven wells, and we assume that they will maintain their rights. We also assume that they will fix upon a small royalty, that will not be burdensome.

(299) W. W., Wayne, Pa., writes: I have a cylinder 16 inches diameter × 10 feet long. I desire to raise the equivalent of 6,000 pounds 10 feet in 20 seconds. I have to do this, the pressure in a 6-inch street main which indicates 64 pounds to the square inch at its best, but there are times when the pressure is reduced to 40 pounds. How small a pipe could I use to convey water from the street main to cylinder—a distance of 30 feet? Cylinder and street main are on a level. Will a 1¼-inch pipe be sufficient? *A.*—No; you will need a pipe 2½ inches in diameter.

(300) J. P., West Bay City, Mich., asks: 1. Is wood dust in factories explosive, and if so, under what conditions? *A.*—Extremely fine dust of almost anything combustible is explosive under certain conditions not very well understood. There probably *might* be conditions in a wood-working establishment, where the air was filled with very fine dry dust, when, if it was lighted, as by a match or lamp, combustion would be so rapid as to be termed an explosion. Fortunately, this condition

is not likely to occur. 2. What is meant by a constant number? *A.*—Some term, as in an equation, which is always the same, no matter how much the other terms may differ.

(301) W. G. M., New Glasgow, Nova Scotia, writes: A pair of engines with 30-inch cylinders are to be connected by a 12-inch exhaust pipe; the condenser is 200 feet away from the engine. What will be the effect on the vacuum in the exhaust pipe 200 feet long? *A.*—You will have considerable trouble in starting the engine, because it will have to make several turns to create a vacuum in such a long exhaust pipe. After the engine has been running a little while and a vacuum established, there should be no further trouble, providing all the joints are perfect, and suitable arrangements made for the expansion of the pipe.

(302) Water Wheel, Augusta, Ga., writes: I am in charge of two turbine water wheels, of 450 horse-power each. The shafts are 8 inches diameter, steps of white oak, 10 inches diameter. One of the wheels gives trouble by wearing out the step, and I should like to know the cause. What is best material for step? Would using regulator on wheel affect the step? *A.*—It is our opinion that white oak is not a good material for step. We think lignum vitæ is what you should use for the step. We do not see, as you state the case, that the regulator has anything to do with the wearing down. The manufacturers of your wheels should be able to give you valuable information as to steps.

(303) B. C., Battle Creek, Mich., asks: Please give me the proper length and width of steam and exhaust ports for a 5¼"x6" engine; also the outside and inside lap and travel of the valve. *A.*—Steam ports ¼ of an inch wide, 3 inches long; exhaust port, 1 inch wide, 3 inches long; lead, 1-64 of an inch; outside lap, ⅝ of an inch; inside lap, none; throw of the eccentric, 2¼ inches—that is, 1⅛ inches from center of shaft to center of eccentric. The travel of the valve will be 2⅛ inches, if no rocker with arms of unequal lengths is interposed. With ports of this size and lap as given, steam will be cut off very nearly at three-quarters of the stroke, and the engine will be capable of making 350 revolutions per minute.

(304) Inquirer, Meadville, Pa., writes: In a certain pumping station is a condensing pumping engine, and by the advice of the pump manufacturer the water company are using the water from the hot well to supply their boilers, not using any heater. They are using two boilers set in a connecting battery, no division wall between them. The boilers are fed at the rear end from one large pipe, two smaller pipes, with a check valve in each, leading into each respective boiler. There is also an equalizing pipe in the bottom of front heads of the boilers. They are very much troubled with foaming, particularly in the boiler nearest the pump. Will you please give me your opinion of such practice? *A.*—The practice is good; you will see this arrangement used on steamships. As regards the foaming, it is impossible to point out the cause without seeing the boilers and general arrangement, or having a drawing of the same.

(305) R. D., Lowell, Mass., asks: 1. Can steel be case-hardened, and if so, how? *A.*—Case-hardening is a process of converting the surface of iron to steel, and then hardening it. Applied to steel proper, the term is a misnomer. So-called steel that will not harden by the ordinary process of heating and cooling may be treated like wrought-iron for getting a hard surface. If it is desirable to get a hard surface on steel, leaving the center comparatively soft, heat the outside quickly in a lead bath and cool in water. 2. By what means can steel be hardened the hardest? *A.*—For all practical purposes, steel can be hardened in pure water. There is an opinion shared by some that it can be made harder by cooling in salt water, oil of vitriol or mercury. 3. What is the process for hardening cast-iron? *A.*—We do not know of any practicable process except by chilling in the mould.

(306) R. H., Jersey City, N. J., writes: I have a 40 horse-power boiler, which I run at about 25 horse-power the year around. I have been using an injector for feeding, no heater being used. Now, if there is a system of water works upon which a pressure of, say, 70 lbs., is maintained, by connecting this with feed to force water into boiler what will be saved over feeding with the injector, the boiler pressure being kept at 55 or 60 lbs.? *A.*—It is doubtful if you will be able to detect any saving. At the best it would simply be the power required to force the water into the boiler, which is quite insignificant. Against this is the fact that with the injector the water is heated, and heating the water, even though live steam is used to do it, is economical. On general principles, we should say there was no economy in the plan you outline. If you could use the hydrant pressure to force the water through an exhaust heater, then you would find a material saving.

(307) J. G. T., Corvallis, Oregon, asks: 1. Does not the lap of the slide valve terminate the point of stroke of piston that the steam port is exactly closed? *A.*—In machine shops it is a general expression that "the lap regulates the point of cut-off." Such an expression is liable to lead to error, because it is not only the lap, but it is also the position of eccentric which will terminate that part of the stroke at which steam is cut off. Whenever the lap is changed, the position of the eccentric must also be changed, and consequently, if you mean that the lap only of a slide valve terminates the part of the stroke at which steam is cut off, we say it does not; but if you mean that the lap and the position of eccentric determines the point of cut-off, we answer, these do determine the point of cut-off. 2. Does not hooking up the link merely shorten the travel of the valve, or, in other words, lessen the opening of the steam port? *A.*—Hooking up the link will shorten the travel of the valve, and consequently will lessen the opening of the steam ports. 3. Explain how the shortening the travel of the valve will cause the steam port to be closed at different positions of the crank-pin. *A.*—See AMERICAN MACHINIST, page 6, November 21, 1885, and in connection with this paper see AMERICAN MACHINIST, page 4, November 7; page 1, October 24; and page 2, October 10, 1885.

(308) W. H., Newburg, N. Y., writes: I have a marine boiler of the drop leg, return flue type, the shell being 11 feet diameter and 30 feet long. The water below the line of bottom flues is apparently dead; that is, without circulation. The boiler being filled with cold water, fires started and steam generated, the water below the fire line remains cold. I am renewing the bottom flues and bottom of bridge wall and back connection. It is my opinion that the deterioration of metal in these parts is due to unequal expansion. I proposed as a means of relief to induce circulation by connecting two 7-inch pipes coming out from shell about three or four feet below the water line to a 10 inch tee opening from bottom of shell about midway of its length. Please give me the benefit of your experience in the matter as to what extent circulation will be induced by this means. *A.*—Our experience is that your plan is about right, and the very best thing to do. The only point on which we should differ from you is in the location of pipes. We should let them come out from the boiler quite up to the water line, and somewhat forward (towards the fire) from the center. Generally speaking, your idea is excellent and full of common sense; not only this, but it has been found to work satisfactorily under similar conditions.

(309) W. G. J., Chattanooga, Tenn., writes: Will you kindly settle a dispute I have with a friend in regard to the velocity of water in pipes, and the quantity discharged in a given time? In order to make matters clear, we will take the following example: The steam cylinder of a duplex pump is 14 inches diameter; the water cylinder, 4 inches diameter; steam pressure, 110 pounds per square inch; number of strokes per minute, 130. The pump is connected to a press whose plunger is 12 inches in diameter, and will raise 3 feet. The pump and the press are connected by a pipe 2 inches diameter, 23 feet long. Now, I argue that putting in a pipe 2½ inches in diameter, instead of the 2-inch pipe, the velocity will be reduced, but the plunger of the press will raise faster. My friend says the plunger will not raise as fast by the change, on account of reducing the velocity. Which is right—my friend or I? *A.*—Both you and your friend are wrong. The speed of the plunger in the press does not depend upon the diameter of the pipe which connects the press to the pump, but it depends upon the speed and diameter of the water plunger in the pump; and as long as the diameter and speed of this water plunger remain the same, the speed of the plunger in the press will also remain the same. Making the diameter of the pipe, which connects the pump and press, larger or smaller, will decrease or increase the friction in the pipe, and consequently the power necessary to work the press will be decreased or increased by changing the diameter of the pipe.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

New Book for Machinists. See adv., p. 16.

Link-Belting.

Send for catalogue of Link-Belting.

Over 50,000,000 feet of Link Belt in use.

Link-Belt Machinery Co., Chicago and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Edw. Sears, Wood Engraver, 189 William st, N. Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Air Compressors, Rock Drills. J. Clayton, 43 Dey st., N Y

Exhaust Tumbl'g Bbls. Henderson B's., Waterb'y, Ct.

For Improved Cooper Stoves, send to Variety Machine Co., Warsaw, N. Y.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., Y. N.

Robbs' Patent Composition for case-hardening. Send for circular. F. W. Tasney, Paterson, N. J.

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Injectors, Ejectors, Oil Cups, Sight Feed Lubricators, etc. Arthur Appleton, 45 Cortlandt st., N.Y.

20", 25", 28" B.G. and S. F. upright drills for immediate delivery. Currier & Snyder, Worcester, Mass.

Ice and Refrigerating Machines. 124 built, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

Drawing Materials, all kinds. Get catalogue. Mention this paper. G. S. Woolman, 116 Fulton st., N. Y.

For Sale—Very successful Single-Valve Automatic Governor Patent. Address Patent, AM. MACH.

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co., 111 Liberty st., N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

Machinists' supplies, brass goods, m'f'rs' supplies, polishing materials, all kinds wire, metals, etc.; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

Press for sale. Quick-acting; hole in bed, 8x5 punches to center of 13-inch sheet; 2¼-inch shaft; also four-spindle Drill. B. W. Payne & Sons, Elmira, New York.

Best and latest Window-Sash Fastener. Principle entirely new. Sashes securely fastened, closed or raised one or more inches. Agents wanted. Trade supplied. Circulars free. Territory for sale. Santford Mfg. Co., Box 509, Omaha, Neb.

Reed's Engineer's Hand-Book to the Local Board Examinations. Eleventh edition revised and enlarged, with 260 diagrams and 36 large plates. 8vo., cloth, $4.50, post-paid. Catalogue of books free. E. & F. N. Spon, 35 Murray st., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York

MANUFACTURES.

Columbus, Kan., is to have water-works.

Salt Lake City, Utah, wants more and better water.

A pumping engine is wanted for the Flushing (L. I.) water-works.

A pulp mill, with capacity of ten tons daily, is to be built at Centralia, Wis.

Peter Duffy will build a factory at 542-544 West Fortieth street, New York.

Maynard, Middlesex County, Mass., is figuring on establishing water-works.

The Fort Worth (Texas) Electric Light Company will build an incandescent plant.

W. H. Brimberry will build a saw mill, a grist mill, also a ginnery, at Camilla, Ga.

At Carlinsville, Ill., they are looking for some company that will build water-works.

George E. Kelley and others expect to build large stamping works at Birmingham, Ala.

The new foundry and machine shop of Alway & Hurspool, Otsego, Mich., is nearly completed.

The water power at Sault Ste. Marie will soon be developed by a corporation with $1,000,000 capital.

John J. Bowes will build a six-story brick factory, 46x90 feet, at 231-233 West Twenty-ninth street, New York.

Hon. Frank Jones, of Portsmouth, N. H., has purchased land at Kansas City, Mo., on which to erect a brewery.

A. Hill contemplates building a four-story brick factory on Columbia street, near Nelson street, Brooklyn, N. Y.

C. H. Prentiss, Otsego, Mich., has plans nearly completed for the town building, engine room being on first floor.

Subscriptions to the amount of nearly $100,000 have been made in Seneca Falls, N. Y., towards building a flouring mill.

The Owego Water Works Company, Owego, N. Y., have commenced putting in a mammoth water filter, at a cost of $4,000 to $5,000.

The D. & H. Scovil Hose Works are building a shop 200 feet in length at Higginum, Conn. Part of it is to be used as a machine shop.

Nearly all the machinery used in operating the Sherman division of the Texas and Pacific road has been removed from Bonham to Texarkana.

William Bullis, of Glen's Falls, N. Y., claims to have discovered a mountain of coal in Warren county, N. Y., in the vicinity of North Creek.

The Taunton Locomotive Works, Taunton, Mass., will soon be enlarged by about 3,000 feet of floor room. The growth of their printing press business calls for the enlargement.

A company has been formed at Abingdon, Va., to establish a manufacturing town, to be called Damascus. The name of the company is the Damascus Enterprise Company.

The Cortland Omnibus and Car Company, Cortland, N. Y., have begun building foundations for their new shops on their lots at the corner of Pendleton and Railroad streets.

The Dallas (Tex.) *News* says the proposed cotton and woolen mill will certainly be built. A meeting was held at which 250 persons were present. A board of directors was elected.

The citizens of Jackson, Tenn., have raised more than $33,000, which they propose to donate, together with a site, to any company that will build and operate a cotton mill at that place.

The Bridgeport Saw and Planing Mill Company, Bridgeport, W. Va., has been incorporated by W. B. Stone, O. D. Barnes, A. W. Lang, A. J. Lodge, S. O. Kester and James Dunkin, all of Bridgeport.

W. J. Keever, B. D. Spillman, J. N. Camden, J. A. Wetherell and J. N. Camden, Jr., have organized the Consumers' Coal and Mining Company to develop 300 acres of coal lands at Camden City, W. Va.

Geo. B. Rownson, of Springfield, Mo., has patented a pipe-bending machine, that he informs us will bend 2" or 4" wrought-iron tubing, 2" being bent in any desired shape. He bends pipe cold without wrinkles.

The Missouri Malleable Iron Company, St. Louis, Mo., are fully two months behind their orders. The foundations for their new foundry addition are now laid, and the building will probably be ready for occupancy by July 1st.

A charter has been issued to the Cresson and Clearfield Coal and Coke Company, the principal office of which is at Frugality, Cambria County, Pa. The capital is $1,000,000, and Geo. T. Bliss, 28 Nassau street, New York, is treasurer.

The Superheated Water Company, D street, between Ninth and Tenth streets, Washington, D. C., is the name of a company which proposes to heat buildings in that and other cities by conducting hot water in pipes underground through the streets.

The Watts-Campbell Company, Newark, N. J., have just completed a 1,200 horse-power tandem compound engine for the Mile End Thread Mill, East Newark. The fly-wheel for this engine is 26 feet diameter, with a 9½-foot face, and weighs 120,000 lbs.

According to the Providence *Sunday Journal*, there is talk of a new line of steamers to ply between the port of Pawtucket, R. I., and New York city. One version is that a propeller steamer is already under construction at Athens, N. Y., for this line.

A new corporation has been organized at Fall River, with a capital of $1,000,000, to manufacture a combination of zinc and mercury, for use in telegraph batteries, under a patent granted to John Beattie. D. A Chapin is president, and F. E. Bosworth, secretary.

It is reported that Major E. C. Gordon, president of the Decatur Land Improvement and Furnace Company, Decatur, Ala., has concluded agreements with the Louisville and Nashville Railroad Company, whereby that town secures new railroad shops, to employ 1,500 men.

The Edison Light Fuel Gas Company, of Grand Rapids, Mich., have purchased property at corner of Calder and Fulton streets, that city, on which they will erect a large building to cover the entire block. Work will commence on stringing wires within the next twenty days.

The A. Schwarzwalider Manufacturing Company, manufacturers at Belleville, Mo., of wheat-cleaning machines, have applied to the Secretary of State of Illinois for articles of incorporation. The capital of the company is $10,000, with A. Schwarzwalider, Jacob Knoebel and Charles Tiedman, incorporators.

Work was commenced on the extensive Soo car shops this week, and the first of the masonry will be laid next week. Twelve buildings will be erected at once, and the entire plant, to include twenty buildings, will, when completed, cover over thirty acres of northeast Minneapolis dirt.—*Minneapolis Spectator.*

The Union Iron Works Company, Chattanooga, Tenn.—capital stock, $50,000—has been incorporated by D. McIntosh, of Pennsylvania, and Alfred Webb, F. I. Stone, W. E. Reynolds and F. F. Wiehl. The company will enlarge and operate the boiler works of A. Webb & Co. and the barb wire factory of F. I. Stone.

The Volker & Felthousen Manufacturing Company, Buffalo, N. Y., will soon begin the construction of a new factory upon a tract of land which they have recently purchased in the suburbs of the city. The new factory will give them greatly-increased facilities, and they expect to add to their line of manufacture that of high-duty duplex pumping engines.

The editor of the West River *News*, South Londonderry, Vt., writes us: "Please to say to any one looking for a good place to manufacture, that if they will come here and employ 25 men in manufacture of any kind they can have 50 to 75 horse-power—water—with buildings, etc., free of rent and taxes. Plenty of lumber, chair and butter-tub, furniture, etc., stock; plenty of wool at 23 cents: plenty of bark at $5 per cord; plenty of labor cheap. What more is wanted?"

The Hubbard (Ohio) *Enterprise*, regarding the tin plates made at Hubbard, says: "The plates manufactured by this company show a decided improvement in both color and quality over the imported plates, and are bound to recommend themselves to the practical tinner. In conversation with Mr. Hutchins, the manager, he stated that the venture of tin plate making was a success in the Hubbard mill, and that when running steadily and to their fullest capacity, they would be able to make a thousand boxes of first-class plates per month. The company propose to put their plates on the market at the same price of imported goods, and will rely on the superior quality and finish of their product to make its way in the market, and already orders from abroad are being filled."

Machinists' Supplies and Iron.

NEW YORK, June 30, 1887.

There is nothing new in the general course of business. The past week has developed some uncertainty as to future prices of iron, owing to the conference between manufacturers and the Amalgamated Association.

American Pig—Prices remain unchanged. We quote for standard brands No. 1 X Foundry, $21 to $21.50; No. 2 X, $19.50 to $20; Grey Forge, $17.50 to $18.50.

Scotch Pig—Prices are still firm in Glasgow. Sales have been made of Coltness, $22 to $22.50; Gartsherrie, $21.50 to $22; Summerlee, $21.50 to $22; Eglinton, $20.50 to $21; Dalmellington, $20.50 to $21.

Antimony—Hallett's, 8¼c; Cookson's, 9c.

Copper—The market is quiet, without sign of change. Lake has sold at 10c., but bids are mostly 9.90c.

Lead—Prices are inclined lower. Sales have been made at 4.60c.

Spelter—Refined continues to sell at 5¾c. to 6c.

Tin—Jobbing lots of Banca have sold at 23¼c., but are hardly obtainable at that figure. Straits and Malacca have sold at 23½c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Engineer and draftsman, competent and reliable desires engagement. Address Box 42, AM. MACH.

Wanted—By an experienced patternmaker, situation as foreman. Address Box 39, AM. MACHINIST.

Foundry foreman of experience and ability desires a position; highest references. Address Box 38, AM. MACHINIST.

Wanted—Position by young married man familiar with general machine shop work, drafting and designing of machinery. Derf, AM. MACHINIST.

Wanted—Position in office or to travel, by mechanical engineer; age 30; specialty, marine and railroad machinery; A 1 references and record. Address S. X., AM. MACHINIST.

A mech. draftsman, graduate from technical school abroad, with some practical experience, wants situation as assistant draftsman; age 21. Address A., 668 Henry st., Brooklyn, N. Y.

Situation wanted as ass't superintendent or ass' manager by a young man—responsible party, experienced mechanic and designer; good references Address N. H. L., care AM. MACHINIST.

Wanted—"A Yankee contractor" wanted in a shop engaged in manufacturing small engine lathes; must be able to get work out quick and cheap. Address "Lathe," care AM. MACHINIST.

A. C. Christensen, mechanical and hydr. engineer, late chief draftsman for Henry R. Worthington. Designs and working drawings; also patent drawings. 26 Church st., R. 13 and 14, New York.

Wanted—A man to travel for sale of injectors, oilers, lubricators and other boiler appliances; must be posted in injector trade, and be a good salesman and have good references. Address J., care AM. MACHINIST.

Machinist of several years' experience would like situation where a knowledge of electric lighting would be of use; can design and build a first-class dynamo independent of existing patents. Address Electrician, AM. MACHINIST.

Wanted—A competent foreman for a machine shop (in a Western city) manufacturing mining machinery, engines, and doing general machine work. Address, stating age, previous experience, references and salary expected, D. F., AM. MACH.

Mechanical engineer, designer of engines and boilers of every description, stationary and marine, 5 years' experience as draftsman during building of the largest Russian petroleum manufactory, having knowledge of everything belonging to refining, transportation and burning petroleum, speaking Swedish, English, German and Russian languages, wishes a situation suitable for him. Address S. W., AM. MACHINIST.

✝ MISCELLANEOUS WANTS. ✝

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent Boiler Tube Expander; second to none, price in reach of all. Crescent Mfg. Co., Cleveland, O.

The Crescent Link Belt Coupling; something new; sample free. Crescent Mfg. Co., Cleveland, O

Wanted—The address of man'f'rs of fur fulling machines. P. W. Spencer, Milwaukee, Wis.

Patent for sale; slide valve for direct-acting steam pump. Address Box 41, AM. MACHINIST.

Light mach'y of all kinds built at short notice Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

Stationary boat engines, boilers, best, cheapest, 1 to 10 H. P. Washburn Engine Co., Medina, Ohio.

For Sale—One Bradley cushioned helve hammer. Apply to Arthur F. Whitin, Treas., Whitinsville, Mass.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. I. A. Weston & Co., Syracuse, N. Y.

Wanted—To arrange with manufacturers of stationary boilers throughout the country to construct and put on the market my multi-tubular expansion boiler, of which the marine type is illustrated in the present issue of the AMERICAN MACHINIST. J. W. Walters, 162 South st., New York.

For Sale—One thirty-five and one forty horse-power boiler, made by Fox; also one fifty horse-power engine, made by Armington & Sims; all in good running order. To be sold on account of putting in larger engines and boilers. J. Lichtenstein & Sons, 281, 283, 285, 287 Grand street, N. Y.

Manufacturing Business for Sale—I have a long-established commercial business which requires my entire time; I also own controlling interest in and have been managing the business of a corporation manufacturing a useful patented machine, demand for which is growing more general each year. In past five years 150 machines have been sold at prices ranging from $125 to $1,000; all are giving best of satisfaction. I want to dispose of the manufacturing business to some person or firm having the financial and mechanical ability required to extend the business, which can be made a large one. Will stand thorough investigation. Address Box 40, care AM. MACHINIST.

BRADLEY'S HEATING FORGES.

ESTABLISHED 1832.

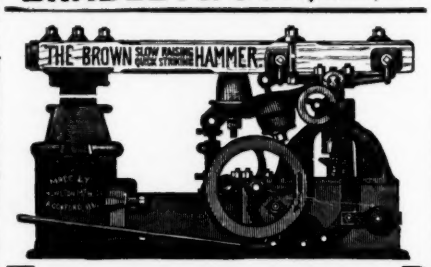
For Hard Coal or Coke. Indispensable in all shops to keep **Bradley's Cushioned Hammers** and men fully employed and reduces cost of production.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER

Established 1832.

Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

BRADLEY & CO. Syracuse, N.Y.



THE BROWN HAMMER
STRIKES A BLOW WITH
Double the Velocity That it Raises the Hammer.
A NEW MOVEMENT! SEND FOR DESCRIPTION.
KNOWLTON MFG. CO., KING ST., ROCKFORD, ILL.

Iron and Steel
DROP FORGING
Of Every Description, at Reasonable Prices.
THE R. A. BELDEN CO., DANBURY, CT.

GUILD & GARRISON,
BROOKLYN, N. Y.
STEAM PUMPS,
VACUUM PUMPS,
AIR COMPRESSORS.
SEND FOR CATALOGUE.

STEPHENS PATENT VISES.

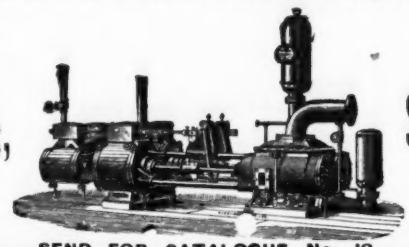
ONE-HALF TIME and LABOR saved by using this solid, strong, durable firm-hold, quick working Lever (Not Screw) Vise. Has improved Taper Pipe and other attachments. Sold by the trade. Send for circular.
TOWER & LYON,
95 Chambers Street, New York
Successors to MELVIN STEPHENS

93 Liberty St., NEW YORK. | 113 Federal St., BOSTON.

IMPROVED PUMPING MACHINERY | For Every Class of Work | SEND FOR NEW ILLUSTRATED CATALOGUE.

THE DEANE STEAM PUMP CO., Holyoke, Mass.

BUILD Water Works, ENGINES AND Steam Pumping MACHINERY.



SEND FOR CATALOGUE No. 18.

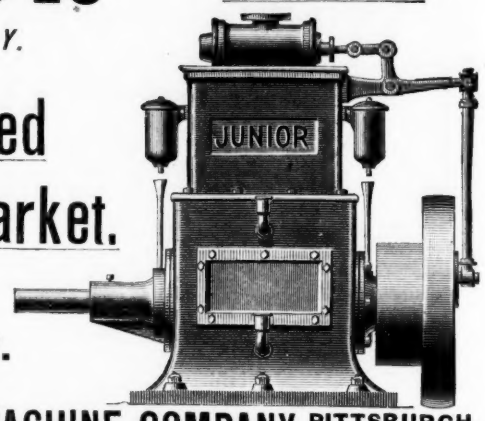
IF YOU WANT A
SHAPER, PLANER, DRILL, LATHE OR SPECIAL MACHINERY,
WRITE TO
THE HENDEY MACHINE CO.,
SEND FOR A CATALOGUE. TORRINGTON, CONN.

THE "JUNIOR" AUTOMATIC ENGINE.

15, 25 & 35 H.P. ONLY.

The Lowest-Priced Engine in the Market.

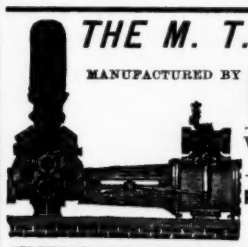
WELL BUILT AND SERVICEABLE.



The WESTINGHOUSE MACHINE COMPANY, PITTSBURGH, PA.

Sales Department for the United States conducted by

WESTINGHOUSE, CHURCH, KERR & CO., 17 Cortlandt st., N.Y., Hamilton Bldg, Pittsbgh., Pa.
FAIRBANKS, MORSE & CO., - - Chicago, Ill
FAIRBANKS & CO., - - - - St. Louis, Mo.
PARKE & LACY, - - - - San Francisco, Cal.
IRON BAY MFG. CO., - - - - - - - - - - Marquette, Mich.
UTAH & MONTANA MACH. CO., Salt Lake, Utah.
D. A. TOMPKINS & CO., - - Charlotte, N. C.
ROBERT MIDDLETON, - - - Mobile, Ala.
H. DUDLEY COLEMAN, - - New Orleans, La.
KEATING IMPLEM'T & MACH. CO., Dallas, Tex.



THE M. T. DAVIDSON IMPROVED STEAM PUMP,
MANUFACTURED BY DAVIDSON STEAM PUMP COMPANY.
WARRANTED THE BEST PUMP MADE FOR ALL SITUATIONS.
PRINCIPAL OFFICE, No. 77 LIBERTY STREET, N. Y.
NEW ENGLAND OFFICE, 51 OLIVER STREET, BOSTON, MASS.

STEAM HEATING FOR BUILDINGS,

Or, Hints to Steam Fitters. Being a description of Steam Heating Apparatus for Warming and Ventilating Private Houses and Large Buildings, with Remarks on Steam, Water and Air in their Relations to Heating. To which are added useful miscellaneous tables. By Wm. J. Baldwin. Eighth edition, revised and enlarged. With many illustrative plates. 12mo, cloth, $2.50.

"Mr. Baldwin has supplied a want long felt for a practical work on Heating and Heating Apparatus."—*Sanitary Engineer.*

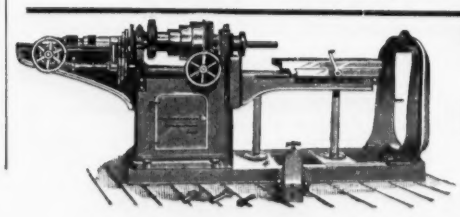
JOHN WILEY & SONS, 15 Astor Pl., N. Y.
Publishers of Scientific and Industrial Works.
*** Will be mailed and prepaid on the receipt of the price. Catalogues and Circulars free by mail.*

SEBASTIAN, MAY & CO.'S
Improved Screw Cutting
FOOT or POWER LATHES.

Catalogue of Lathes, Drill Presses and Machinists Tools and Supplies mailed on application. *Lathes on Trial.*
167 W. Second St., CINCINNATI, O

The BEST in the World.
SUSTAINED BY THE U. S. COURTS.
The DUPLEX, UNION and ALERT INJECTORS.

Simple in construction. Easily taken apart. No springs to get out of order. Always ready. Always delivers water hot to boiler. Thousands in use and demand increasing. Send for Catalogue, to
JAS. JENKS & CO., Detroit Mich., or to
A. APPLETON, 45 Cortlandt Street, N. Y.



BETTS MACHINE COMP'Y,
WILMINGTON, DEL.,
MAKERS OF
Metal-working Machine Tools
OF SUPERIOR QUALITY,
FOR USE IN
MACHINE AND RAILWAY SHOPS.

COOKE & CO., DEALERS IN
Machinery and Supplies,
22 CORTLANDT ST., NEW YORK.
AGENTS FOR

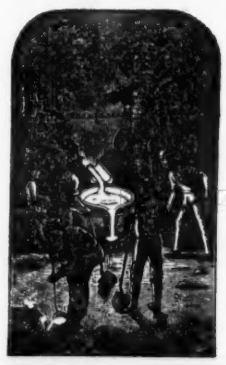
The Waters Perfect Governor.

Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats. Also,

SUPPLIES

For Machinists, Railways, Mills, Mines, Etc.

Please send for circular and state that you saw the advertisement in this paper.



T. SHRIVER & Co's
IRON FOUNDRY,
333
East 56th St.,
NEW YORK.
Contracts Solicited for Machinery Castings in regular supply.

NICHOLSON FILE COMPANY, *Sole Mfrs. of*

FILES and RASPS Having the Increment Cut, also, FILERS' TOOLS and SPECIALTIES.

The above illustration represents a device in which files may be held for service in surface filing, and while in this condition READILY SPRUNG, in order to give at the will of the operator, more or less convexity to the working face of the file. It does away with unusual care to obtain a true convexity or "belly" to file sides, and in fact renders great service by enabling the operator to utilize the file to its full capacity.

SURFACE FILE HOLDER No. 4, Adapted to Hold Files 12, 13 14 in. Long.
" " " " 5, " " " 14, 15, 16 "

MANUFACTORY AND OFFICE - - PROVIDENCE, R. I., U. S. A.

THE HANCOCK INSPIRATOR.

THE STANDARD

BOILER FEEDER FOR ALL CLASSES OF BOILERS.

OVER 85,000 IN USE.

Send for Circulars and Price Lists.

THE HANCOCK INSPIRATOR CO.

OFFICE, 33 INDIA WHARF, BOSTON, MASS.

THE NEW "GRESHAM" PATENT AUTOMATIC RE-STARTING INJECTOR

"Invaluable for use in Traction, Farm, Portable Marine and Stationary Boilers of all kinds. No handles required. Water supply very difficult to break. Capability of re-starting automatically, immediately after interruption to feed from any cause."

SEND FOR CATALOGUE. RELIABLE AND CHEAP.

Sole Manufacturers in the United States and Canada.

NATHAN MANUFACTURING CO.

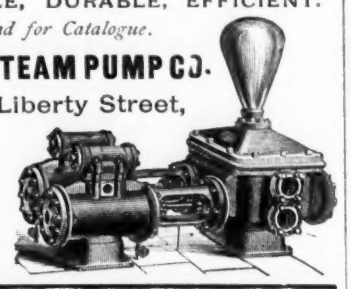
92 & 94 LIBERTY ST., - - - NEW YORK.

HALL Duplex Steam Pump

FOR ALL DUTIES.

SIMPLE, DURABLE, EFFICIENT.

Send for Catalogue.



HALL STEAM PUMP CO.

91 Liberty Street,

NEW YORK.

PARK MFG. CO.

MANUFACTURER OF

34 Beach Street, Boston, Mass.

The Park Injector,

EJECTORS AND JET APPARATUS.

C. W. LE COUNT,

South Norwalk, Conn.

REDUCED PRICE OF LE COUNT'S HEAVY STEEL DOG

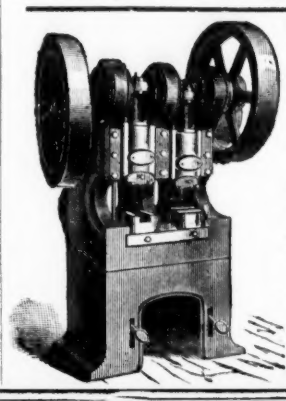
No.	Inch.	Price.
1	3-8	$ .40
2	1-2	.50
3	5-8	.60
4	3-4	.60
5	7-8	.70
6	1	.70
7	1 1-8	.80
8	1 1-4	.80
9	1 3-8	.95
10	1 1-2	.95
11	1 3-4	1.10
12	2	1.20
13	2 1-4	1.35
14	2 1-2	1.45
15	3	1.60
16	3 1-2	1.80
17	4	2.10
18	4 1-2	2.75
19	5	3.35
Full set of 19		$23.60
20 (ext.) 5 1-2		4.00
21 (ext.) 6		5.00

This Dog has a Very Heavy Bore, so that if the thread wears, a Heavier Screw can be substituted.

With Steel Screws, Lathe Made and Hardened When ordering, state as above, whether a full set or a set of 11, or a small set of 8. Users of these dogs prefer them to any other make.

Le Count's Heavy Steel Dog.

One Small Set of 8—by 1-4 inches to 20 inch ..... $ 6.25
One Set of 12—by 1-4 in. to 2 in. continued by 1-2 in. to 4 in. 13.20



BEAUDRY'S DUPLEX Power Press

COMBINING PRESS, SHEARS AND PUNCH.

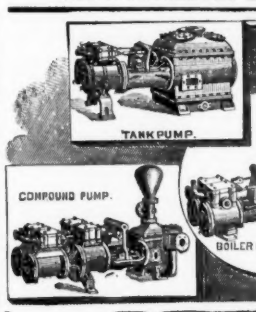
BEAUDRY & CO.

(Formerly of Beaudry's Upright Power Hammer.)

Sole Manufacturers.

Also manufacturers of HARD COAL HEATING FORGES.

Room 4, MASON B'DG, 70 KILBY ST., Boston, Mass.



THE VOLKER & FELTHOUSEN MFG. CO.

MANUFACTURERS OF BUFFALO DUPLEX STEAM PUMPS.

CHURCH BIRDS ALL & MECHANIC ST. BUFFALO N.Y.

For Sale at Factory Prices by

A. Aller, New York; S. C. Nightingale & Childs, Boston; Henry I. Snell, Philadelphia; Thos. J. Bell & Co., Cincinnati; Shaw, Kendall & Co., Toledo; Geo. Worthington & Co., Cleveland; N. O. Nelson Mfg. Co., St. Louis, Mo.; Goulds & Austin, Chicago; Kennedy & Pierce Machinery Co., Denver, Col.; Sheriff & Ashworth, Pittsburgh, Pa.; Jos. Baur, Manistee, Mich.; Jas. Jenks & Co., Detroit, Mich.; Wickes Bros., East Saginaw; Adolf Leitelt, Grand Rapids; E. F. Osborne & Co., St. Paul, Minn.; Rundle, Spence & Co., Milwaukee, Wis.; Joshua Hendy Machine Works, San Francisco; Flynn & Emrich, Baltimore, Md.; Forbes Liddell & Co., Montgomery, Ala.; Bailey & Lebby, Charleston, S. C.; Pond Engineering Co., St. Louis and Kansas City, Mo.; O. B. Goodwin, Norfolk, Va.; Columbus Supply Co., Columbus, O.

THOS. D. WEST FOUNDRY CO., Cleveland, Ohio,

Manufacturers of Light and Heavy Iron Castings in Green, Dry Sand or Loam, also Machinery and Architectural Wood or Metal Patterns for Outside use. Patterns constructed durably and to mould in the most advantageous manner.

P.H. & F.M. ROOTS,

Connersville, Indiana,

MANUFACTURERS OF

PORTABLE FORGES, TUYERE IRONS, ETC.

ROOTS' NEW ACME HAND-BLOWERS.

Slow-speeded, Force-blast. Durable, Compact and Cheap.

Roots' Foundry Blowers, Gas Exhausters, etc.

S. S. TOWNSEND, Gen. Agt. } 23 CORTLANDT ST.,
COOKE & CO., Selling Agts., } NEW YORK.

In Writing, Please Mention This Paper.

PRICE REDUCED.

FIRE AND WATER-PROOF BUILDING FELT, FIRE-PROOF PAINTS, STEAM PACKINGS, BOILER COVERINGS, ETC.

Samples and descriptive Price List free by mail.

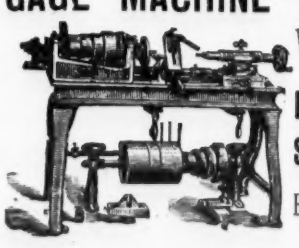
H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.

MARK YOUR TOOLS!

With Steel Stamps, and SAVE TIME AND EXPENSE.

Send for Catalogue of Stamps, Chucks, &c.

GAGE MACHINE WORKS,



Waterford, N. Y

Manuf'r's of

Fox, Turret AND Speed Lathes AND Brass Finishers' TOOLS.

EDWARDS' PRACTICAL STEAM ENGINEER'S GUIDE.

RECENTLY PUBLISHED.

The Practical Steam Engineer's Guide in the Design, Construction and Management of American Stationary, Portable and Steam Fire Engines, Steam Pumps, Boilers, Injectors, Governors, Indicators, Pistons and Rings, Safety Valves and Steam Gauges. For the use of Engineers, Firemen and Steam Users. By Emory Edwards, Author of "A Catechism of the Marine Steam Engine," etc. Illustrated by 119 engravings. 3d edition, revised and corrected. In one volume. 12mo, 420 pages, $2.50, *free of postage to any address in the world.*

Abstract of Contents.

Introduction. Chapter I. Standard American Stationary Engines. II. Standard American Stationary Boilers. III. Standard American Portable Steam Engines and Boilers. IV. Standard American Agricultural Engines. V. Standard American Steam Fire Engines. VI. Standard American Steam Pumps. VII. Injector. VIII. Steam Engine Governors. IX. The Steam Engine Indicator. X. Slide Valves. XI. The Piston and its Rings. XII. Safety Valves, their Antecedents, Invention, History and Calculation. XIII. Steam Gauges. XIV. Practical Notes on the Management of Steam Engines and Boilers. Index.

BY THE SAME AUTHOR.

Modern American Locomotive Engines, their Design, Construction and Management. Illustrated. 12mo, 383 pages, - - - - - - - - - - $2.00

Modern American Marine Engines, Boilers, and Screw Propellers. Their Design and Construction. Showing the Present Practice of the most Eminent Engineers and Marine Engine Builders in the United States. By Emory Edwards. Illustrated by 30 large and elaborate plates. 4to, - - - - - - - - - - - - $5.00

A Catechism of the Marine Steam Engine. For the use of Engineers, Firemen and Mechanics. A Practical Work for Practical Men. Illustrated by 63 engravings, including examples of the most modern engines. Third edition, thoroughly revised, with much new matter. 12mo. 414 pages. - - - - - - - - - - - - $2.00

☞ *The above or any of our Books sent by mail free of Postage, at the publication price, to any address in the world.*

☞ *An illustrated circular, 6 pages, 4to, showing the full table of contents of each one of Emory Edwards' works, sent free and free of postage to any one in any part of the world who will furnish us with his address.*

☞ *Our new Catalogue of Practical and Scientific Books, 96 pages, 8vo, as well as a Catalogue of Books on Steam and the Steam Engine, Mechanics, Machinery, and Dynamical Engineering, and a catalogue of Books on Civil Engineering, Bridge Building, Strength of Materials, Railroad Construction, and other Catalogues, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.*

HENRY CAREY BAIRD & CO.,

INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS,

810 Walnut St., Philadelphia, Pa., U. S. A.

LARGE LATHES IN STOCK.

One 42 in. x 18 ft. bed, treble-geared; ready.

One 36 in. x 16 ft. bed, treble-geared; ready.

One 32 in. x 18 ft. bed, treble-geared; ready.

One 32 in. x 20 ft. second-hand, back-geared.

The above are held at low prices.

THE NEWARK MACHINE TOOL WORKS,

Newark, N. J.

FITCHBURG MACHINE WORKS.

Manufacturers of

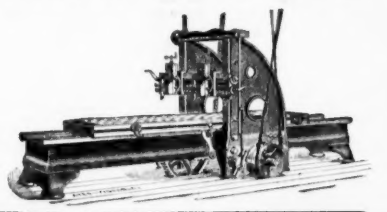
METAL-WORKING MACHINES.

Office and Works,

13 to 21 Main Street,

FITCHBURG, MASS.

Send for Catalogue (E.)



WHY THIS IS PUT HERE!

For the reason that if you are interested in raising water or other liquids by steam power, we wish to call your attention to the

NEW PULSOMETER,

THE CHEAPEST AND BEST STEAM PUMP IN THE MARKET. PRICES LOWER THAN ANY OTHER.

More Efficient, Simple, Durable, and more Economical, both as to running expenses and repairs, than any other Steam Pump.

Call or write for our new 96 page Illustrated Descriptive Book containing Full Particulars, Reduced Net Prices, and hundreds of A-1 Testimonials. Mailed Free.

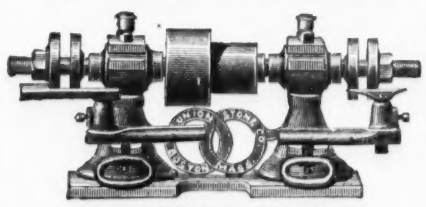
PULSOMETER STEAM PUMP CO., 83 JOHN STREET, N. Y.

FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS.

JAS. HUNTER & SON, North Adams, Mass.

UNION STONE CO.,

38 & 40 Hawley St., Boston, Mass.



No. 1 GRINDING MACHINE.

Has 1 in. Arbor. Takes Emery Wheels to 14" diameter. Is specially adapted to grinding tools and light work of similar character.

We Manufacture Grinding Machinery and Emery Wheels for all classes of Work.

Diamond Tools and Emery-wheel Dressers

FOR REMOVING GLAZE, AND SHAPING THE FACE OF WHEELS, AS REQUIRED.

CATALOGUE ON APPLICATION.

SHEPARD'S NEW $60 SCREW-CUTTING FOOT LATHE.

Foot and Power Lathes, Drill Presses, Scroll-saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc.

Lathes on trial. Lathes on payment.

Send for catalogue of Outfits for Amateurs or Artisans.

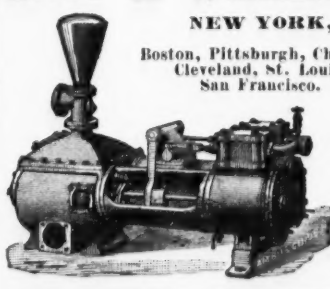
Address, H. L. SHEPARD, Agent, 134 E. Second St., Cincinnati, O.

WORTHINGTON PUMPING MACHINERY

HENRY R. WORTHINGTON,

NEW YORK,

Boston, Pittsburgh, Chicago, Cleveland, St. Louis, San Francisco.



SEND FOR Illustrated Catalogue.

SAFE ECONOMICAL DURABLE
HARRISON SAFETY BOILER WORKS. PHILADELPHIA. PA.
BOILERS
MERITS PROVEN 20 YEARS RECORD

"STEAM" A VALUABLE BOOK for EVERY STEAM USER AND ENGINEER
PUBLISHED FOR FREE DISTRIBUTION, BY
THE BABCOCK & WILCOX CO.
Manufacturers of
WATER-TUBE BOILERS,
107 Hope St., GLASGOW. 30 Cortlandt St., NEW YORK.

BRIDGEPORT BOILER WORKS.
BRIDGEPORT CONN
SEE THE IMPROVEMENTS IN STEAM BOILERS, BOILER FRONTS, BOILER FURNACES, AND FEED WATER HEATERS MADE AT THESE WORKS BEFORE BUYING STEAM PLANT. SEND FOR HISTORIES OF STEAM BOILERS AND FFED WATER HEATERS (FREE) ON MENTIONING THIS PAPER. WM. LOWE.

NEWBURGH STEAM BOILER WORKS. P. DELANY.
NEWBURGH, N.Y.
MANUFACTURER OF STEAM BOILERS OF EVERY DESCRIPTION
CARRY A LINE OF BOILERS IN STOCK FOR IMMEDIATE DELIVERY.

"LITTLE GIANT."
THE BEST INJECTOR,
For Feeding all Steam Boilers.
RUE'S EJECTOR,
Superior to all others for Raising and Forcing Water and other Liquids.
RUE M'F'G. CO., PHILA., PA.
CATALOGUES FREE.

HYDROSTATIC MACHINERY
PRESSES, PUMPS, PUNCHES, ACCUMULATORS, JACKS, VALVES, FITTINGS, Vault Elevators, &c.&c.
Watson & Stillman,
204-210 E. 43d St., N.Y.

New Haven Manf'g Co.
NEW HAVEN, CONN.
IRON-WORKING MACHINERY.

"THE ONLY PERFECT"
BUFFALO
Portable Forges.
The Lightest, Strongest, Most Durable, Easiest Working, and in every way THE BEST Portable Forge Made.
Buffalo Forge Co.,
BUFFALO, N. Y.

FOX'S CORRUGATED BOILER FURNACES
MANUFACTURED BY
THE LEEDS FORGE CO., Limited, of England
SAMSON FOX, C. E., Manager.
Best Yorkshire Steel (Siemens') Boiler Plates.
J. BEAVOR-WEBB, 41 BROADWAY, N. Y
AMERICAN AND CANADIAN AGENT.

WORCESTER MACHINE SCREW CO.
WORCESTER, MASS.
Machine Screws for all Purposes.
All Goods Shipped Direct from Factory.

WALKER'S TOOL HOLDER.
For holding drills and reamers for lathe work. Prevents breaking or slipping. Can also be used for drilling and reaming holes by hand, and for reaming holes under drill presses, etc. Made with double handle, when required.
WALKER MFG. CO.,
CLEVELAND, OHIO.

VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

THOS. H. DALLETT & CO.
13th & Buttonwood Sts., PHILA. PA
Manufacturers of
PATENT
Portable Drilling Machines,
VERTICAL DRILLS,
Radial Drills, Multiple Drills,
HAND DRILLS.
SEND for ILLUSTRATED CATALOGUE.

IMITATION.
AN ACKNOWLEDGMENT OF SUPERIORITY.
The best evidence that the JENKINS BROS. VALVES, JENKINS STANDARD PACKING, and JENKINS DISCS have extraordinary merit, and are held in high esteem by the public, is that they are being IMITATED and COUNTERFEITED. The imitations resemble the original in appearance only: they lack the general excellence of the genuine. Our friends and customers will sustain us in our endeavor to manufacture the best goods, by not accepting any goods unless stamped as above. This notice has become necessary by the fraudulent use of our name, and to protect the public from being deceived by unprincipled parties placing imitations on the market.
JENKINS BROS., 71 John Street, N. Y.; 105 Milk Street, Boston.; 13 South Fourth Street, Phila.; 54 Dearborn Street, Chicago.

WESTCOTT CHUCK CO., ONEIDA, N. Y.
MANUFACTURERS OF
LATHE and DRILL
CHUCKS
SEND FOR CATALOGUE.
GEARED CHUCKS.
Jaws Reversible.

Diameter.	Capacity.
5 inch.	5 inch.
7⅛ "	7⅛ "
10⅛ "	10⅛ "
13 "	13⅛ "
15¼ "	17 "
18 "	19¾ "
21 "	25½ "
24 "	28 "

William Barker & Co.
Manufacturers of
IRON AND BRASS
—WORKING—
MACHINERY
140 & 142 E. Sixth Street,
N'r Culvert, Cincinnati, O.
Send for circulars and prices.

MACHINISTS' SCALES,
Patent End Graduation.
We invite comparison for accuracy with all others
Every Scale Guaranteed. Send for List.
COFFIN & LEICHTON, SYRACUSE, N. Y.

A Complete Cutting-off Machine, $4.00
Larger ones which cut to 2 in. $8.00
SENT ON TRIAL.
Drill Presses, Tap Drill Gauges.
STERLING ELLIOTT, Newton, Mass.

"CUSHMAN" CHUCKS
Are guaranteed to be right in all respects. Ask to see them at your dealers, or write direct to the factory. Respectfully,
THE CUSHMAN CHUCK CO.,
HARTFORD, CONN.

HOOPER'S 70% GRATE BAR.
Will not Warp.
Will not burn off at the ends.
Will give absolutely 70% air space.
Will give uniform combustion of fuel.
Send for Circular and Price List to
ALEXANDER TRAUD,
EAST FERRY STREET IRON WORKS,
NEWARK, N J.

ESTABLISHED 1851.
The Horton Lathe Chuck.
THE E. HORTON & SON CO.
Canal St., Windsor Locks, Conn., U. S. A.

The Almond Coupling
A NEW quarter turn motion to replace quarter turn belts and bevel gears.
T. R. ALMOND, Mfr.,
83 & 85 Washington Street,
BROOKLYN, N. Y.

DISCOUNT TO CLUBS. WRITE FOR FULL LIST.
HARDENED
STEEL SQUARES
and other
Fine Tools,
Manufactured by
STANDARD TOOL CO.
ATHOL, MASS.

STANDARD PUNCHES FOR
I.P. RICHARDS STANDARD DIES PROVIDENCE R.I.
IRON & STEEL PLATES.

Established in 1874.
CLEVELAND TWIST DRILL CO.
24 and 26 West Street, Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.

ONE OF THE FINEST MANUFACTURING PROPERTIES IN THE COUNTRY FOR SALE OR TO RENT.
Buildings built in the most substantial manner of brick and in perfect order, and will last a lifetime without any outlay for repairs. Suitable for any kind of manufacturing where strength, durability and light is required. Buildings now filled with twelve sets of first-class woolen machinery running on fine woolens, in perfect order. This property will be sold or leased with or without the machinery. Now is the time for any one looking for a first-class piece of property to obtain same. It needs only to be seen to be appreciated.
Address P. O. Box 1102, Providence, R. I.

L. S. STARRETT,
Manufacturer of
FINE TOOLS
ATHOL, MASS.
SEND FOR FULL LIST.

HILLES & JONES,
WILMINGTON, DEL.
PUNCHES & SHEARS
Improved
A FULL LINE OF Horizontal Punches.
BOILER-SHOP TOOLS.

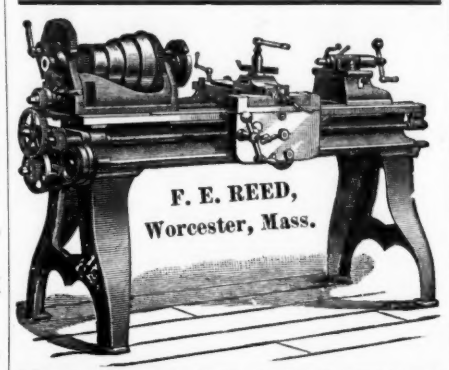
Morse Twist Drill and Machine Comoany, New Bedford, Mass.
Manufacturers of **Morse Patent Straight-Lip Increase Twist Drills.**

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills,
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

STEEL BALLS
FOR ANTI-FRICTION BEARINGS,
OF BEST CAST STEEL.
HARDENED, GROUND & BURNISHED,
3-16" to 3" Diameter.
Samples and Prices on application.
SIMONDS ROLLING-MACHINE CO.
FITCHBURG, MASS.

WELDLESS STEEL QUICK OPENING GATE VALVE COLD DRAWN TUBES
SMOOTH INSIDE & OUT.
JOHN S. LENG, 4 Fletcher St N.Y.

BEVEL GEARS,
Cut Theoretically Correct.
For particulars and estimates apply to
BREHMER BROS.
Machinists,
440 N. 12th St., Philadelphia, Pa.

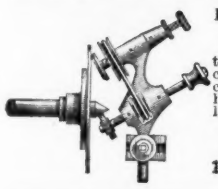


F. E. REED,
Worcester, Mass.

ENGINE Lathes, Hand Lathes, Foot Lathes, Upright Drills and Milling Machines. Agents, MANNING, MAXWELL & MOORE, 111 LIBERTY STREET, NEW YORK.

Nickel Plated Pocket Level.

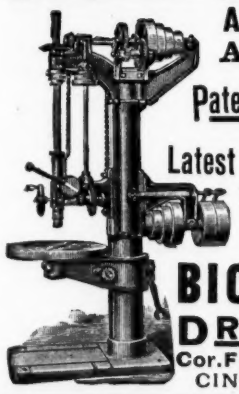
No. 11
2½-in. 60 cents. 3½-in. 75 cents.
By Mail on Receipt of Price.



Friction Driven Center Grinder.
A neat, simple and cheap tool to true up centers, will grind centers up quicker than they can be annealed, turned and hardened, will go on any size lathe without any adjustment.
Send for descriptive circular
ENERGY M'F'G CO.
1115 to 1123 S. 15th Street,
PHILADELPHIA, PA.

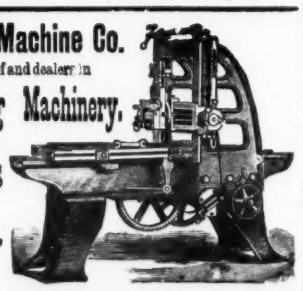
PATENT
PLANER and SURFACE GAUGE.
An accurately graduated gauge by which planer and other tools can be quickly set at any height from the table or the work. Is also a convenient surface gauge. $3.75 each.
ARTHUR B. PHILLIPS, Manufacturer,
WHITMAN, MASS.

UPRIGHT DRILLS
A SPECIALTY.
ALL SIZES
—WITH—
Patent Quick Return
—AND—
Latest Improvements.

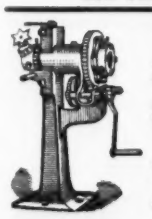


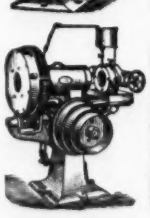
For Catalogues and Prices, address,
BICKFORD DRILL CO.
Cor. Front & Pike Sts.
CINCINNATI, O.

L. W. Pond Machine Co.
Manufacturers of and dealers in
Iron Working Machinery.
IMPROVED
IRON PLANERS
A Specialty.
140 Union St.,
WORCESTER, MASS.



NEW YORK AGENTS.
FRASER & ARCHER,
NEW AND SECOND-HAND MACHINERY,
SHAFTING, HANGERS AND PULLEYS.
121 CHAMBERS STREET.

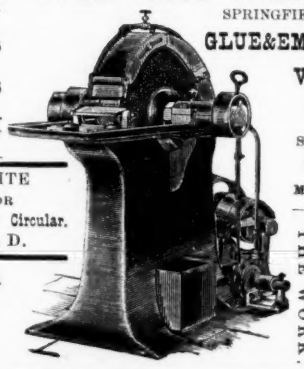




"ECLIPSE" Pipe-Cutting Machines
FOR HAND OR POWER.
Don't you have sufficient Pipe-Work about your Mill, Factory, or Shops to make a powerful, convenient and very compact Pipe-Cutting Machine soon pay for itself, providing it could be had at a moderate price? Mention this paper and write us for particulars.
PANCOAST & MAULE,
Philadelphia, Pa.
Made in Three Sizes, Cutting Pipes ¼ to 6 inch.

S. ASHTON HAND MFG. CO.,
Toughkenamon, Chester Co., Pa.
MAKERS OF FIRST-CLASS
ENGINE LATHES
Are now in position to put on the market.
14" ENGINE LATHES OF NEW DESIGN.
guaranteed to be equal in material, design and workmanship to the best ever offered.

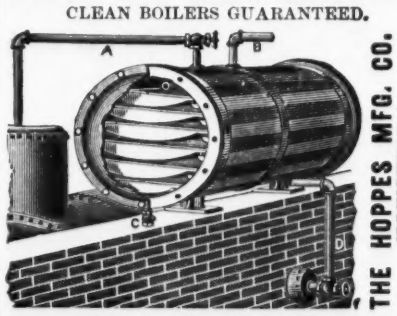
EMERY WHEEL TOOL GRINDER.
55 STYLES AND SIZES
Guaranteed Satisfactory.
WRITE FOR Illustrated Circular. No. D.
Patented Sept. 25, 1883.



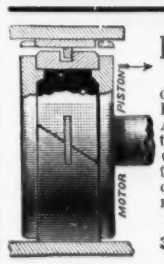
SPRINGFIELD GLUE&EMERY Wheel Co.
Springfield, MASS
Water Prevents HEATING THE WORK.

DRAFTSMEN! If your Stationer does not keep Dixon's American Graphite Artists' Pencils, send 16 cents (mention this paper) and you will receive samples worth double the money.
Dixon's Grade Stamps are as follows:
Similar grade to European Stamp of
V V S—Very, very soft.(B B B)
V S—Very soft... ...(B B)
S—Soft .....(B and No. 1.)
S M—Soft medium...(H B and No. 2.)
M B—Medium black..(F)
M—Medium.....(H and No. 3.)
M H—Medium hard..(H H)
H—Hard.....(H H H and No. 4.)
V H—Very Hard.....(H H H H and No. 5)
V V H—Very, very hard(H H H H H H)
JOS. DIXON CRUCIBLE CO.,
JERSEY CITY, N. J.

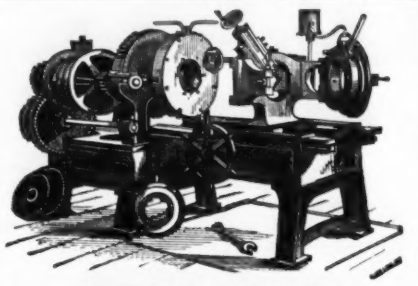
THE NEW HOPPES LIVE STEAM FEED-WATER
Heater and Lime Extractor.
CLEAN BOILERS GUARANTEED.



THE HOPPES MFG. CO.
SPRINGFIELD, O
—Send for Catalogue D.—



Brandon's Piston Ring Packing
Perfectly balanced against undue pressure in all directions. Preserves both cylinder and rings. Allows no waste by either friction or leakage. Call and see working model, expressly made to demonstrate advantages claimed. For packing or shop rights, address
JAMES BRANDON,
390 Eleventh Ave., New York.

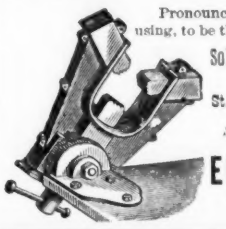


D. SAUNDERS' SONS,
Manufacturers of
Pipe Cutting & Threading Machines
For Pipe, Mill and Steam Fitters' Use.
TAPPING MACHINES,
For Steam Fitting, also
Steam and Gas Fitters' Hand Tools.
YONKERS, N. Y.
SEND FOR CIRCULAR.

—OUR— NEW CATALOGUE OF TOOLS
and Supplies sent free to any address on receipt of Ten Cents in stamps (for postage).
CHAS. A. STRELINGER & CO., Wood Ave., Detroit, Mich.

P. BLAISDELL & CO.
Manufacturers of
Machinists' Tools,
WORCESTER, MASS.

CHALLENGE OPEN TOP PIPE VISE.
Pronounced by practical men, after using, to be the best ever invented.



Sold by all Jobbers in New York Chicago, Philadelphia, St. Louis, Pittsburgh, Canada.
Send for Catalogue "A."
ELGER & ELGER,
49 BROADWAY,
NEW YORK.

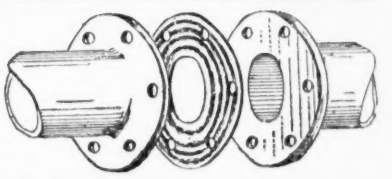
THE New Howe Mfg. Co.
BRIDGEPORT, CONN.
Mfrs. of Sewing Machines
Light and Medium Weight
Gray Iron Castings
OF ALL DESCRIPTIONS TO ORDER; ALSO,
TOOL MAKING, JAPANNING —AND— PLATING.
Correspondence Solicited.

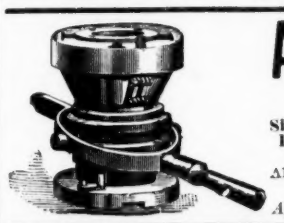
CRANK PLANERS
Superior Design & Workmanship, Extra Heavy (1500 lbs.)
DOWN, ANGULAR AND CROSS-FEED,
TO PLANE 12x16x15.
THE R. A. BELDEN CO., DANBURY, CT.

ECONOMICAL STEAM BOILERS
A SPECIALTY.
SEND FOR PRICES. Pond Engineering Co. ST. LOUIS, MO.

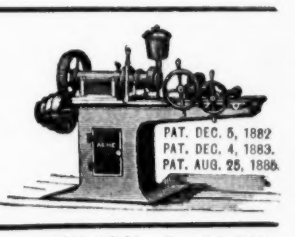
"Twenty Years with the Indicator."—
2 vols., $3.00. By THOS. PRAY, JR., C. & C. E. and C. & M. E. Six thousand sold. J. Wiley's Sons, 15 Astor Place, N. Y., or Thos. Pray, Jr., P. O. Box 2728, Boston, Mass.

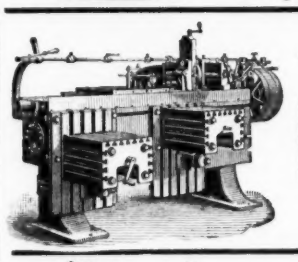
Joints made absolutely tight and durable by pat. corrugated
COPPER GASKETS
Furnished in all shapes and sizes for flanged PIPES, CYLINDERS, CHESTS, Etc.
Price List and Sample Free.
U.S. MINERAL WOOL CO., 22 Cortland St., N.Y.





ACME MACHINERY CO.,
CLEVELAND, OHIO.
Manufacturers of
"ACME"
Single & Double Automatic Boltcutters,
cutting from 3-8 in. to 6 in. diameter,
Also SEPARATE HEADS AND DIES.
Send for Catalogue and Discounts.
Agents, Manning, Maxwell & Moore, New York.





Philadelphia, June 2d, 1886.
E. A. Walker, 75 Laurel St., Philadelphia, Pa.
Having used the "RICHARDS PATENT COMBINATION PLANER AND SHAPER" almost daily, for several months past, I take pleasure in testifying to its merits. I find it an exceedingly useful and desirable addition to the machine shop, easily manipulated, well balanced in all its parts, and accurately constructed; in short, it fulfills all the inventor claims for it, and fully comes up to what I had expected of it from its previous recommendations.
HARRY CAIN, Engineer,
At Powers & Weightman's Laboratory,
Falls Schuylkill, Phila.

SHAPING MACHINES
FOR HAND AND POWER.
6", 8" and 10" Stroke.
Adapted to All Classes of Work to their Capacity.
Circulars Furnished.
BOYNTON & PLUMMER,
WORCESTER, MASS.

UNIVERSAL RADIAL AND RADIAL DRILLING MACHINES
THREE DESIGNS. SIX SIZES
EMBODY ALL DESIRABLE FEATURES
PRICES $450.00 & UPWARD
ADDRESS UNIVERSAL RADIAL DRILL CO
CINCINNATI, O. U.S.A.

W. C. YOUNG & CO., Worcester, Mass. Manufacturers of
Engine Lathes, Hand Lathes
FOOT POWER LATHES, SLIDE RESTS, Etc.

MACHINERY
For Reducing and Pointing Wire.
Especially Adapted to pointing wire rods and wire for drawing.
For Machines or information, address the manufacturer.
S. W. GOODYEAR Waterbury, Ct.

PECK'S PAT. DROP PRESS.
NEW HAVEN
BEECHER & PECK. CONN.
DROP FORGINGS OF IRON OR STEEL
BEECHER & PECK, NEW HAVEN CONN.

OIL CUPS
For Engines, Shafting, &c.
Illustrated Catalogue Free.
J. E. LONERGAN & CO.
Philadelphia, Penna.

HODGE'S
Universal Angle Union
PATENTED.
Combining an elbow and union, and can be set at any angle at which it is desired to run the pipe.
Manufacturers & Wholesale Agents.
HOLLSTONE MACHINE CO., 45 Water St., FITCHBURG, MASS.

PRESSURE REGULATORS
Ours are used and recommended by the leading pump manufacturers.

OUR REDUCING VALVE
will not "chatter" and will maintain an even steam or water pressure as low as one pound.

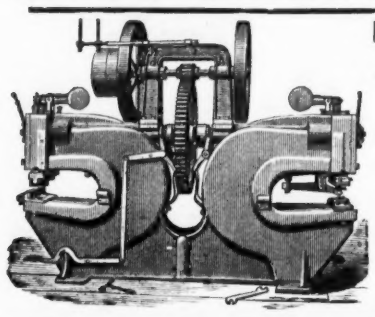
JENKINS BROS., New York & Chicago, Ag'ts.
MASON REGULATOR CO., 22 CENTRAL ST., BOSTON.

CRANES FOR SALE.

Having substituted our HIGH SPEED TRAVELING CRANE for the SWING CRANES heretofore used in our Foundry, we desire to dispose of the latter without delay and will therefore accep' very low prices. These SWING CRANES were designed and constructed by ourselves for our own use. They have had good care, are in good condition, and were of the following capacities when new:

One 50 tons operated by steam engine at base of frame.
One 50 tons operated by hand.
Two 25 tons operated by hand.
Three 10 tons operated by hand.
Full particulars with prices will be given upon application.

WM. SELLERS & CO., Incorporated, Philadelphia, Pa.



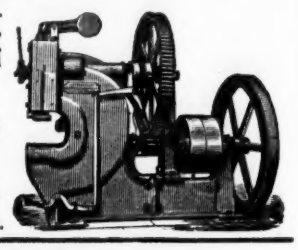
THE LONG & ALLSTATTER CO. Hamilton, OHIO.

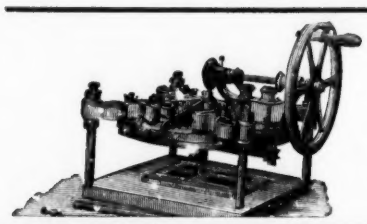
Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven

Punches and Shears.

Over 300 Sizes.
ALSO,
Power Cushioned Hammer.

Send for new Catalogue.





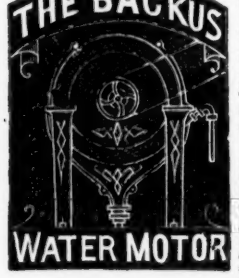
Patent Portable Valve Seat Rotary Planing Machine.

Will Plane off the Valve Seats of Locomotive and other Engines without the use of files or scrapers.

Circulars with full description on application.

PEDRICK & AYER, - Philadelphia, Pa.

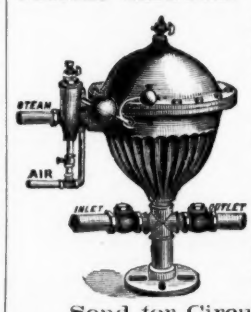
THE BACKUS WATER MOTOR



SUPPLIES FROM HYDRANT PRESSURE the cheapest power known. Invaluable for blowing Church Organs, running Printing Presses, Sewing Machines in Households, Turning Lathes, Scroll Saws, Grindstones, Coffee Mills, Sausage Machines, Feed Cutters, Electric Lights, Elevators, etc. It needs little room, no firing up, fuel, ashes, repairs, engineer, explosion, or delay, no extra insurance, no coal bills. Is noiseless, neat, compact, steady; will work at any pressure of water above 15 lb.; at 40 lb. pressure has 4-horse power, and capacity up to 10-horse power. Prices from $15 to $300. Send for circular to

THE BACKUS WATER MOTOR CO., Newark, N. J.

CURTIS RETURN STEAM TRAP



For returning steam, condensed under pressure, automatically into the boiler, under high or low pressure,

Manufactured by

CURTIS REGULATOR CO.
Boston, Mass.

General Agencies:
109 Liberty St., N. Y.
66 N. 4th St., Phila., Pa.
108 5th Ave., Chicago, Ill.
210 S. 3d St., Minneapolis, Minn.
707 Market St., St. Louis, Mo

Send for Circular No. 17.

REMOVED

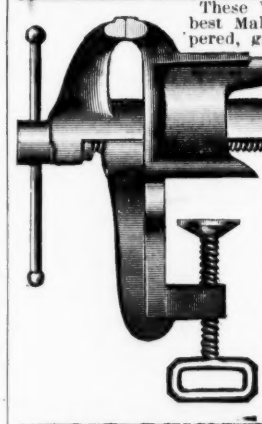
On or about June 1st

H. BICKFORD,

will remove his business to

LAKE VILLAGE, N. H.,

into new shops fitted up with new and latest improved tools, especially adapted for manufacturing Boring and Turning Mills which will be made an exclusive specialty, 4-5-6 and 8 ft. Swing.



These Vises are made from best Malleable Castings, tempered, ground to fit, Screw & Lever, Bessemer steel, bar covers the screw, protecting it from filings and injury. Made in the following sizes: No. 1, Amateur, retails 25c.; No. 1½ clamp, retails 35c.; No. 2, Anvil, 35c.; No. 2½ clamp, 45c; Hand Vise, all Steel, 50c.; No. 3, Anvil, $1.00; No. 3½ clamp, $1.25; No 4, Swivel Base, $2.00.

MANUFACTURED BY
Moore & Barnes Mfg. Co.
103 Chambers St., N. Y.

PATENTS

R. G. Du Bois, Patent Att'y, 916 F St., Washington, D. C. Good references. Send for pamphlet.

THE NATIONAL FEED-WATER HEATER.

A brass coil heater supplying feed water at 210° to 212° Fahrenheit by use of exhaust steam.

Our prices are low and reasonable, and we aim to supply the *cheapest, best and most effective Heater in the market.* Sixteen sizes. 10 H.P., $20; 100 H. P., $150; 500 H. P., $600. Iron, Brass and Copper Coils and Bends made to order. Circulars and price lists sent on application.

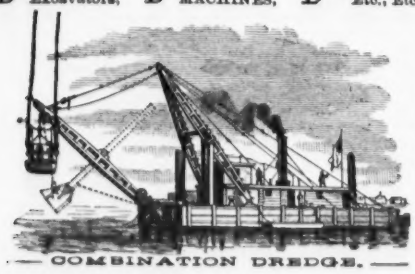
National Pipe Bending Co.
NEW HAVEN, CONN.

OSGOOD DREDGE CO., - ALBANY, N. Y.

RALPH R. OSGOOD, Pres. JAMES H BLESSING, Vice-Pres.
JOHN K. HOWE, Secretary and Treasurer.

Manufacturers of

DREDGES, Excavators, DITCHING MACHINES, DERRICKS, Etc., Etc.



COMBINATION DREDGE.

American Twist Drill Company's PATENT CHUCK JAWS.

Three sizes. Price per set of 4 Jaws, $40, $48, $56. Bolted to lathe face plates, they make best and cheapest chuck in the world. Address orders, Laconia, N. H.

HILL, CLARKE & CO., Boston and St. Louis.
MANNING, MAXWELL & MOORE, N. Y. City.
TALLMAN & McFADDEN, Philadelphia, Pa.
or WM. BINGHAM & CO., Cleveland, Ohio

CHARLES MURRAY
ENGRAVER ON WOOD
58 ANN ST. NEW YORK.

Southwark Foundry and Machine Company,

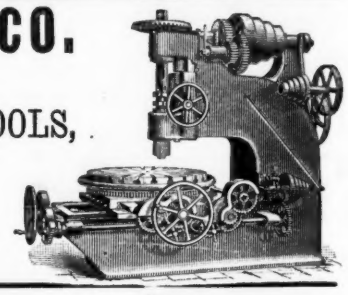
Engineers, Machinists and Boiler Makers,

SOLE MAKERS
Porter, Allen & Southwark Engines.
Blowing & Reversing Engines, Steel & Hydraulic Machinery, Boilers, Tanks, and Gas Apparatus.
INQUIRIES SOLICITED.

Washington Avenue and Fifth Street, - - - PHILADELPHIA, PA.

BEMENT, MILES & CO.

PHILADELPHIA, PA.
BUILDERS OF
METAL-WORKING MACHINE TOOLS,
FOR
RAILROAD SHOPS,
LOCOMOTIVE AND CAR BUILDERS,
MACHINE SHOPS, ROLLING MILLS,
STEAM FORGES, SHIP YARDS,
BOILER SHOPS, BRIDGE WORKS, ETC.

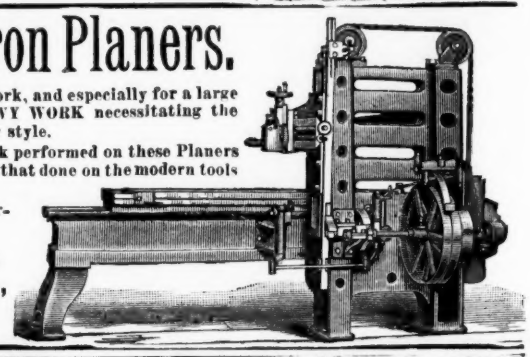


The Open Side Iron Planers.

Adapted for all classes of Machine Work, and especially for a large amount of the EXTRA WIDE and HEAVY WORK necessitating the Large and Costly Planers of the regular style.

The QUALITY and QUANTITY of work performed on these Planers is GUARANTEED to be UNEXCELLED by that done on the modern tools of the very best makes.

Prices, phototypes and detailed information on application.

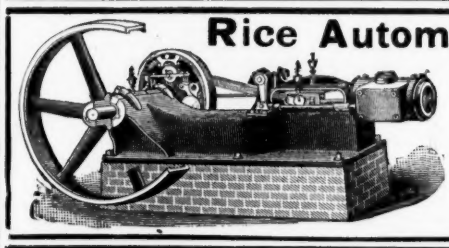


DETRICK & HARVEY,
BALTIMORE, MD.

THE HERCULES TRADE MARK REG. JUNE 12 1883

Section of **Copper-Wire-Sewed Light Double Belting,** specially adapted to use on cone pulleys and other hard places. Manufactured by the **PACE BELTING CO., Concord, N. H.** Also manufacturers of Staple and Special Grades of Leather Belting and the "*HERCULES*" Lacing. Send for Catalogue No. 2.

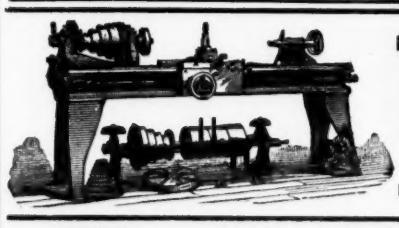
Rice Automatic Cut-off Engine



Self-Contained. Sensitive Governor.
Balanced Valve. High Speeds.
Stationary Oilers. Best Economy.

Gold Medal Cincinnati Exposition, 1884.

THE JOHN T. NOYE MFG. CO.,
BUFFALO, N. Y.



16" ENGINE LATHES

New Designs. First-class Workmanship.

THE MULLER MACHINE TOOL CO.,
Evans and Eighth Streets, - CINCINNATI, O.

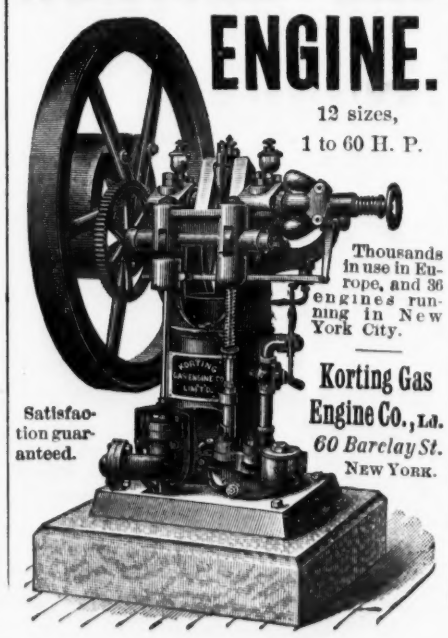
FORBES & CURTIS,

BRIDGEPORT, CT.,
Manufacturers of
The Forbes Pat. Die Stocks,

Power Pipe Cutting and Threading Machines, Cutting-off Machines, Ratchet Drills, Special Machinery, etc., etc.
WRITE FOR CATALOGUE.
Mention Paper.

KORTING GAS ENGINE.

12 sizes,
1 to 60 H. P.

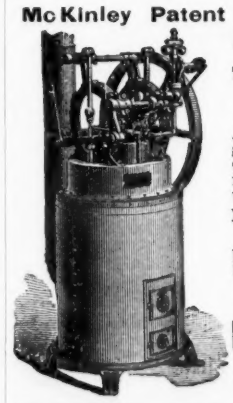


Thousands in use in Europe, and 36 engines running in New York City.

Satisfaction guaranteed.

Korting Gas Engine Co., Ld.
60 Barclay St.
NEW YORK.

McKinley Patent Air Engine.



The Best and Cheapest on the Market.

No Steam. No Water. Absolute Safety. No Engineer. No pumps. No Gauges. No liability to freeze up. No Regulation required.

NO EXTRA INSURANCE.

Can be used for any purpose where power is required.

Cheap Fuel. Cheap First Cost.

McKinley Engine Co.
17 Broadway,
CINCINNATI, O.

E P. B. SOUTHWORTH,

94 Exchange street, Rochester, New York.
Indicating Engineer and Mechanical Draftsman.
Correspondence solicited.

MACHINERY

BARGAIN LIST.

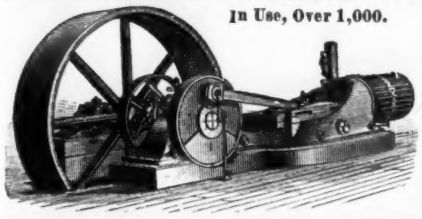
One	16" swing, 6' bed, Engine Lathe (Porter), new.		
"	17" " 6' " " "	(Wright), S.H.	
"	Gray & Woods Planer, 22" wide, 14' long, second hand.		
Two	70 H. P Stationary Boilers, second hand,		
One	60 " " " " "		
"	70 " Portable Engine, " "		
"	30 " " " "	New,	
"	15 " " " "	"	
"	35 " Center Crank Engine, "		
"	12 " " " "	"	
"	20 " Coil Boiler, second hand,		
"	Small Hydro Extractor " "		
"	12 H. P. Vertical Engine, " "		
"	15 " " " " "		
"	30 " Portable "		

With Circular Saw Mill, Saws, Belting and Fixtures complete, second hand.

S. L. HOLT & CO.,
67 SUDBURY STREET, BOSTON, MASS.

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use, Over 1,000. 25 to 1,000 H. P.



These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 100 H P for driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine construction and performance free by mail. **Address, BUCKEYE ENGINE CO., Salem, Ohio.**

SALES AGENTS: W. L. SIMPSON, 301 TELEPHONE BUILDING, 18 CORTLANDT STREET, N. Y. / N. W. ROBINSON, cor. Clinton & Jackson Sts., Chicago, Ill. / ROBINSON & CARY, St. Paul, Minn.

KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA.

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland and Virginia.

OTTO GAS ENGINE AGENCY, NEW YORK,

A. C. MANNING & CO.,

47 DEY STREET,

REMOVES on May 1st, to 18 VESEY ST.

THE ALBANY STEAM TRAP CO.'S

BUCKET AND GRAVITATING

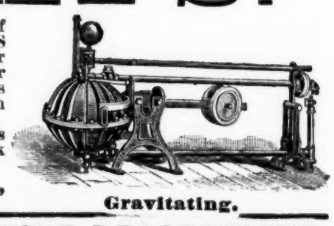
TRAPS.

Bucket.

Automatically drain the water of condensation from **HEATING COILS** and return it to the boilers whether the coils are **above** or **below** the water level in boiler, doing away with pumps and other mechanical devices for such purposes.

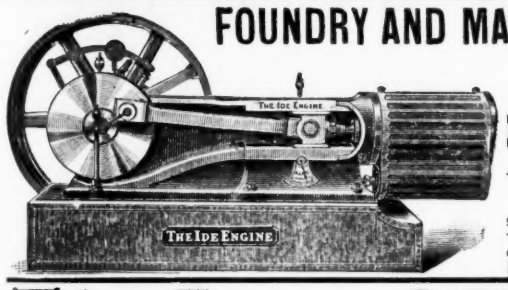
We also manufacture Blessing's **Patent Renewable-Seat Stop and Check Valves.**—Send for Circular.

Albany Steam Trap Co. Albany, N. Y.



Gravitating.

FOUNDRY AND MACHINE DEPARTMENT,



HARRISBURG CAR MFG. CO.

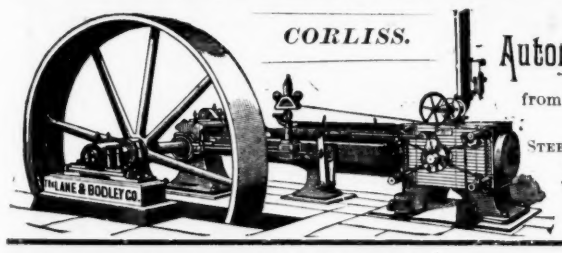
HARRISBURG, PA.

Highest Award SILVER MEDAL and DIPLOMA

AT FRANKLIN INSTITUTE NOVELTY EXHIBITION, PHILADELPHIA.

We are operating the finest and most successful Electric Light Stations in the world. A change of speed not exceeding one per cent. guaranteed, running light and loaded. Send for catalogue.

The Lane & Bodley Co.



MANUFACTURERS OF

Automatic Cut Off Engines,

from heavy patterns and of unexcelled workmanship.

STEEL BOILERS, FEED WATER HEATERS, SHAFTING, PULLEYS & GEARING.

THE LANE & BODLEY CO.

East side John, cor. Water, Cincinnati, O.

PORTER-HAMILTON ENGINE.

FOR HEAVY WORK AND LARGE POWERS.

EXTRA HEAVY DESIGN.

Send for Catalogue.

WILLIAM TOD & CO.,

YOUNGSTOWN, OHIO.

MACHINE TOOLS.

NEW AND SECOND-HAND, ON HAND.

12 in. x 6 ft.	Engine Lathe,		new.
13 in. x 6 ft.	"	Ames,	"
14 in. x 6 ft.	"	Blaisdell,	"
15 in. x 5 & 6 ft.	"	Wood and Light,	good order.
16 in. x 6 8-10 & 12 ft.	"	Bridgeport,	new
16 in. x 6	"	Blaisdell,	"
18 in. x 8 ft.	"	Blaisdell,	"
19 in. x 12 & 14 ft.	"	Pond,	nearly new.
20 in. x 10 ft.	"	Lathe and Morse,	fair.
20 in. x 10 & 12 ft.	"	Ames,	new.
24 in. x 10 14 & 20 ft.	"	Ames,	"
23 in. x 12 & 14 1-2 ft.	"	Bridgeport,	"
24 in. x 16 ft.	"	New Haven,	good order.
26 in. x 16 ft.	"	New Haven,	good as new.
30 in. x 14 ft.	"	W. and L. pattern,	new.
42 in. x 16 ft.	"	Ames,	"
52 in. x 24 1-2 ft.	"	New Haven,	A 1.
54 in. x 30 ft.	"	Niles,	good as new.
87 in. x 20 ft.	"	Wilmot,	fair order.
16 in. x 42 in.	Planer,	Bridgeport,	new.
16 in. x 3 ft.	"	Pratt & Whitney,	good order.
22 in. x 4 ft.	"	Pease,	new.
22 in. x 4 5& 6 ft.	"	Powell,	"
22 in. x 5 ft.	"	Hendey,	new.
24 in. x 6 ft.	"	Hendey,	"
24 in. x 4 ft.	"	Wood and Light,	good.
26 in. x 5 ft.	"	Biglow,	"
26 in. x 7 ft.	"	Brettell,	new.
30 in. x 7 ft	"	New Haven,	fair.
30 in. x 8 ft.	"	Hewes & Phillips,	new.
[illegible] in. x 10 ft.	"	Hendey,	"
36 in. x 8 ft.	"	Wood Light	
36 in. x 12 ft.	"	Niles Tool Works,	A 1.
12 in. Shaper,		Traveling Head,	new.
12 in.	"	Hewes & Phillips,	"
12 in.	"	Carpenter & Plais,	good order
13 in. Stroke, 9 ft. Bed, Trav. Head Shaper,		Barr,	A 1.
20 in. Shaper,		Jeungst,	good as new.
24 in.	"	Bridgeport,	new.
24 in.	"	Wolcott,	"

16 18 20-23 25-28 34 in. Drills. 28 in. & 30 in. Radial Drills.
13 in. Stroke Slotter H. & P. new.
16 in. " Miles, Phila., A 1.
Hor. Boring Mill, Miles, Phila., A 1.
Center Bolt Cutter, new.
Merrill Drops, 400 and 800 lbs., good order.
Bement 2250 lb. Steam Hammer.
Milling Machines Screw Machines, Slate Sensitive Drills, Gang Drills, and full line of all kinds of Machine Tools.
Send for list and specify what is wanted.

E. P. BULLARD,

72 Warren Street and 62 College Place, New York.

THE SKINNER ENGINE CO.

ERIE, PA.

PORTABLE AND STATIONARY

ENGINES and BOILERS

Send for Catalogue and Prices.

HERRICK & COWELL,

Manufacturers of

Drill Presses

POWER AND FOOT PRESSES,

Hand Lathes,

Paper Box and Special Machinery.

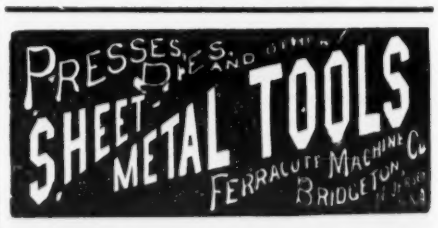
37 ARTISAN ST.,

NEW HAVEN, CONN.

Send for Catalogue.

PATENT UNIVERSAL SCREW-CUTTING CENTER. DEPTH ANGLE AND **J. WYKE & CO.,** **TWIST DRILL GAUGE.**

Fine Machinists' Tools.—**E. Boston, Mass.**—Send for Circular



The Watts, Campbell Co.

NEWARK, N. J.

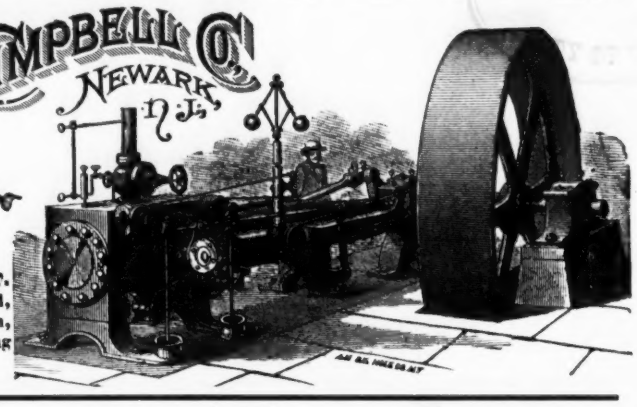
MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.

Sizes Varying From

30 to 2000 Horse Power.

Horizontal or Vertical, Direct Acting or Beam, Condensing, Non-Condensing or Compound.

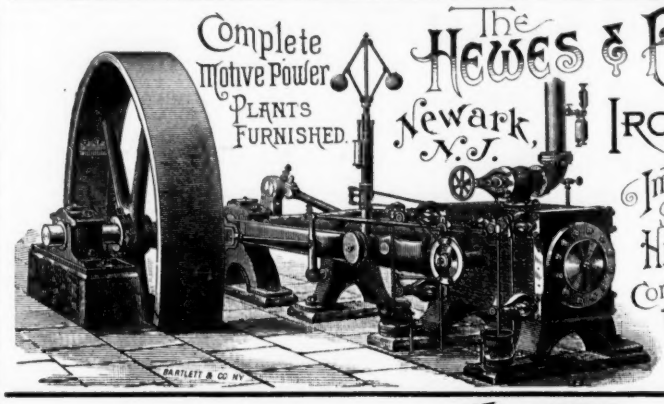
Send for Circular.



The Hewes & Phillips Iron Works

Newark, N. J.

Complete Motive Power Plants Furnished.



Improved CORLISS ENGINES, High Pressure. Condensing and Compound

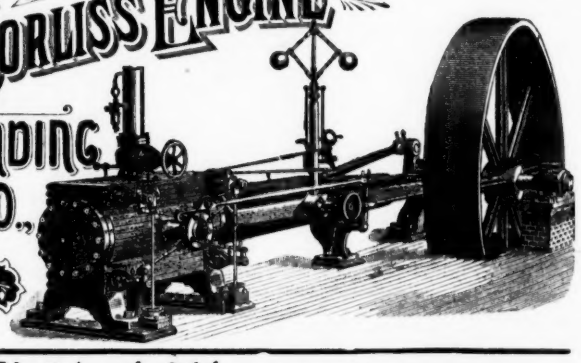
TUBULAR BOILERS.

GEO. A. BARNARD, AGENT.

THE IMPROVED FISHKILL CORLISS ENGINE

BUILT BY THE FISHKILL LANDING MACHINE CO.,

FISHKILL ON THE HUDSON, N. Y.



Robert Whitehill, NEWBURGH, N.Y.

MANUFACTURER OF IMPROVED

CORLISS ENGINES

ALSO SLIDE VALVE ENGINES

STATIONARY BOILERS,

GENERAL MACHINERY,

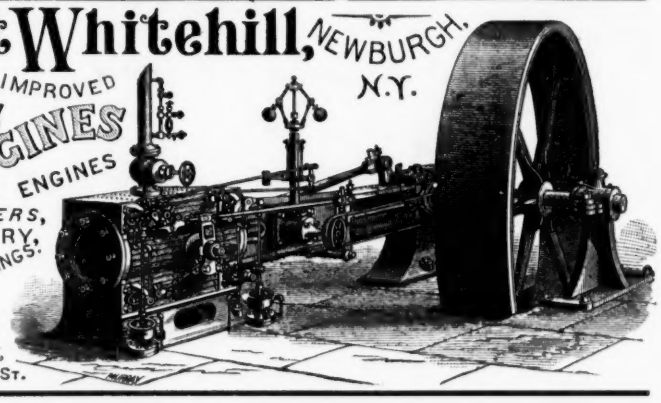
IRON AND BRASS CASTINGS.

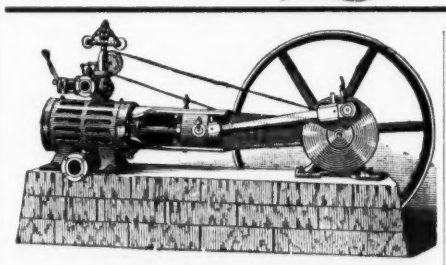
NEW YORK OFFICE

Room 6,

COAL AND IRON EXCHANGE,

COR. CORTLANDT & CHURCH ST.





STEARNS MFG. COMPANY,

ERIE, PA.

Engines from 15 to 400 Horse Power.

Boilers of Steel and Iron supplied to the trade or the user. Send for Catalogues.

SAW MILLS and GENERAL MACHINERY.

Works at ERIE, PA.

Having enlarged our Foundry and otherwise added to our facilities, we are prepared to execute orders for castings weighing from a few pounds to *forty tons*. Our Boring and Turning Mill is one of the largest in the United States, by which we can bore and turn a wheel or cylinder up to 30 feet in diameter, and we can plane 30 feet long by almost any width. With our *unsurpassed* means for handling heavy work, and shipping *by boat or rail*, we are enabled to

OFFER INDUCEMENTS

to customers.

We make a specialty of machinery for making Sugar, and furnish everything necessary to fully equip Sugar Refineries or Plantations. Satisfaction guaranteed, and patronage solicited.

S. S. HEPWORTH & CO.,

"Glenwood Station," Yonkers, N. Y.

JOHN McLAREN,

HOBOKEN, N. J.

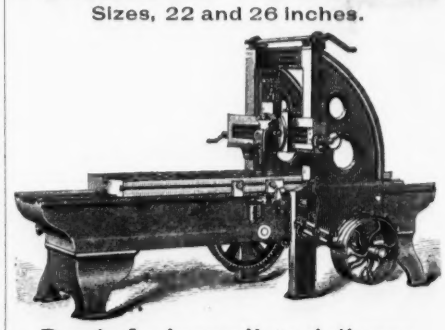
BUILDER OF

CORLISS ENGINES,

AIR COMPRESSORS AND BOILERS.

FLATHER PLANERS

Sizes, 22 and 26 Inches.



Ready for immediate delivery.

26 in. x 26 in. x 6 ft.

26 in. x 26 in. x 8 ft.

HILL, CLARKE & CO.

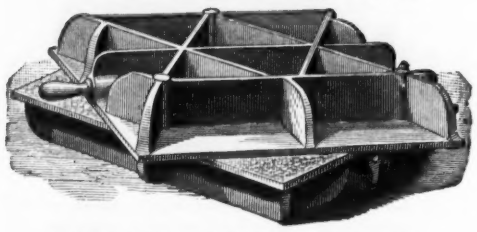
36 Oliver St., Boston.

BROWN & SHARPE MFG. CO.,

MANUFACTURERS OF

MACHINERY AND TOOLS

PROVIDENCE, R. I.



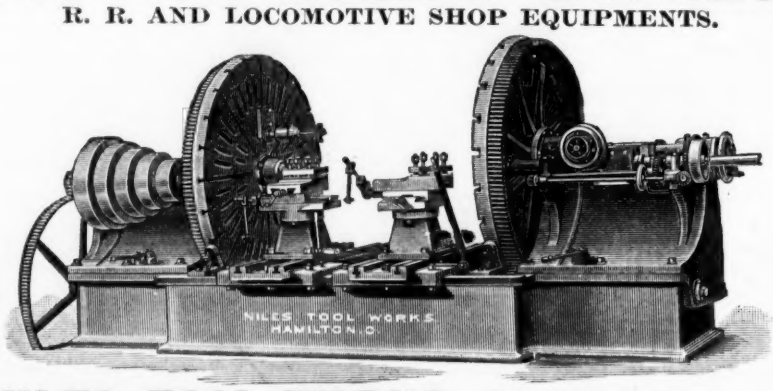
SIZES OF SURFACE PLATES.

4½ in. x 6 in.	9 in. x 9 in.	12 in. x 12 in.	16 in. x 16 in.
6 in. x 6 in.	9 in. x 14 in.	12 in. x 18 in.	18 in. x 18 in.
6 in. x 12 in.	10 in. x 15 in.	14 in. x 14 in.	18 in. x 36 in.
6½ in. x 18 in.	10 in. x 30 in.	14 in. x 18 in.	24 in. x 24 in.
	36 in. x 66 in.		

Illustrated Catalogue Mailed on Application

DRIVING WHEEL LATHES.

R. R. AND LOCOMOTIVE SHOP EQUIPMENTS.



NILES TOOL WORKS.
HAMILTON, OHIO.

NEW YORK, 96 Liberty St.
PHILADELPHIA, 705 Arch St.
CHICAGO, 96 Lake St.

HAND POWER

Traveling Crane

—FOR FOUNDRY USE.—

Particulars on application. Full Specifications and Tender promptly submitted on receipt of capacity and span of bridge desired.

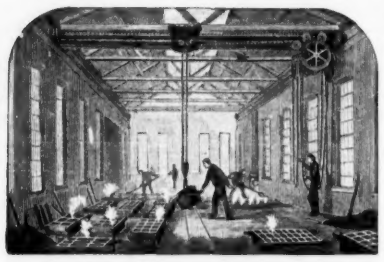
SOLE MAKERS,

THE YALE & TOWNE MFG. CO.

Catalogues on application.

STAMFORD, CONN.

NEW YORK — CHICAGO — PHILADELPHIA — BOSTON.

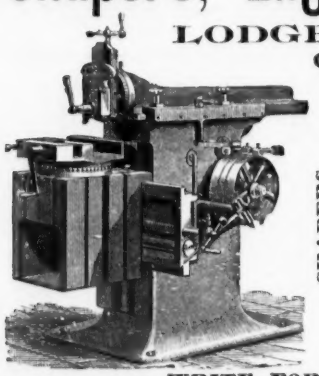


FOUNDRY TRAVELER.

Shapers, Engine Lathes and Drills.

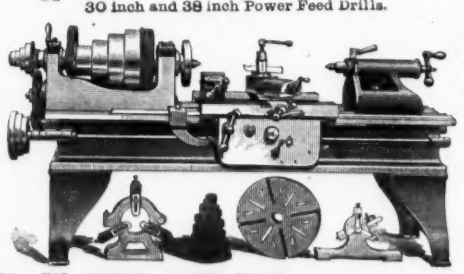
LODGE, DAVIS & CO.,

CINCINNATI, OHIO.



SHAPERS, 6", 8", 10", 20", 26", 32" Stroke.

20 inch Upright Drills. | 26 inch Back Geared and
24 " " | 30 inch and 38 inch Power Feed Drills.



WRITE FOR PRICES, IT WILL PAY YOU.

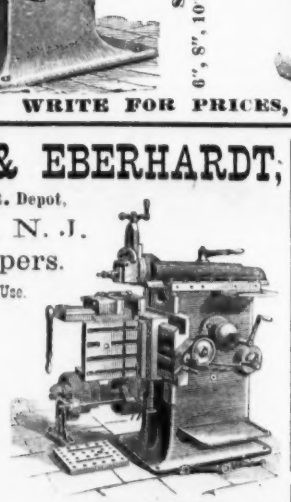
GOULD & EBERHARDT,

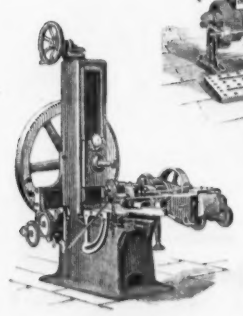
Near Market St. Depot,

Newark, N. J.

Pat. Shapers.

Over 1,000 in Use.





EBERHARDT'S

Patent

GEAR CUTTER,

In Use throughout the WORLD.

E. E. GARVIN & CO.

139 & 141 CENTRE ST., NEW YORK,

Manufacturers of

MACHINISTS' TOOLS

Small Automatic Miller,

WITH ARM.

The Machine shown in cut is designed for rapid and convenient milling of small work.

Send for Catalogue.

THE PRATT & WHITNEY CO.,

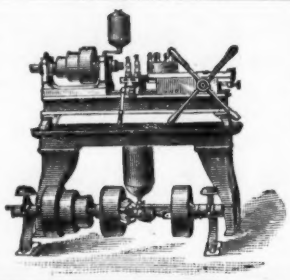
HARTFORD, Connecticut.

MANUFACTURE

HORIZONTAL

Boring Mills,

48 in. and 66 in. Swing.



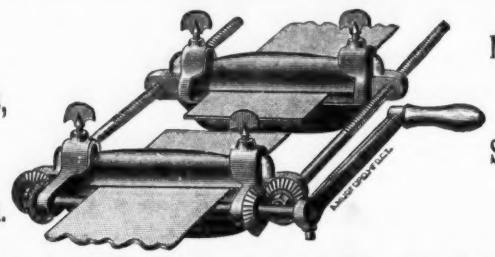
Double Head Traverse Drills

For ⅝ in., 3 in. and smaller holes.

Revolving Head Drilling Machines.

THE BILLINGS & SPENCER CO., Hartford, Conn.

Belt Clamps, IN Eight Sizes, FROM Eight Inch TO Thirty-six Inch.



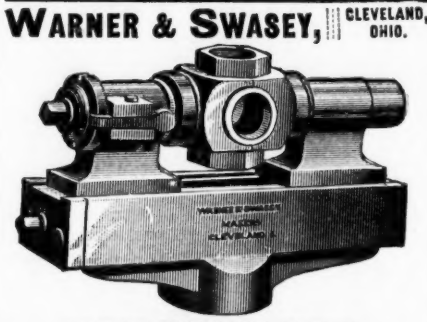
Machinists' Tools, Sewing Machine Shuttles AND Bobbins.

DROP-FORGINGS OF EVERY DESCRIPTION.

SEND FOR CIRCULAR.

WARNER & SWASEY,

CLEVELAND, OHIO.



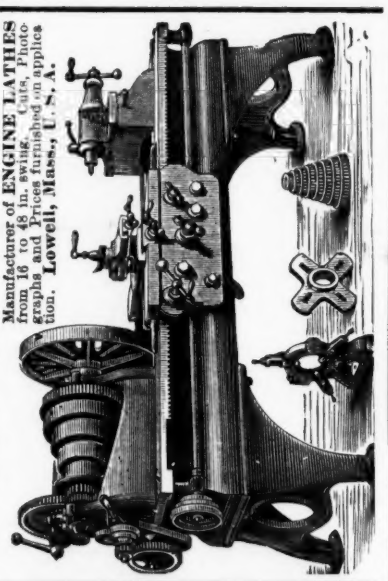
GLOBE VALVE CHUCK.

BRASS WORKING MACHINERY.

ILLUSTRATED CATALOGUE ON APPLICATION.

GEO. W. FIFIELD,

Manufacturer of ENGINE LATHES from 16 to 48 in. swing. Cuts, Photographs and Prices furnished on application. Lowell, Mass., U. S. A.



ENGINE LATHES,

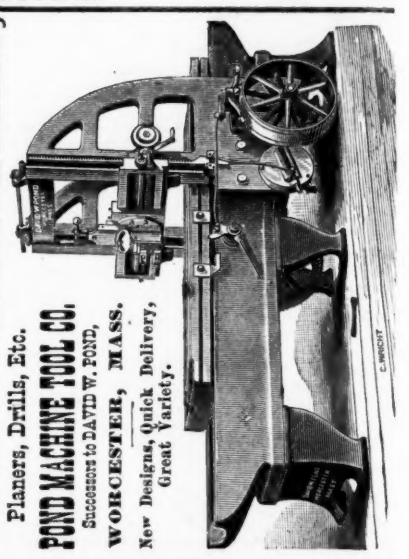
Planers, Drills, Etc.

POND MACHINE TOOL CO.

Successors to DAVID W. POND,

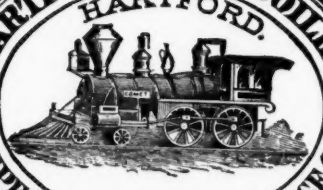
WORCESTER, MASS.

New Designs, Quick Delivery, Great Variety.



HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

HARTFORD, CONN.



J. M. ALLEN, PRESIDENT.

W. B. FRANKLIN, VICE-PRESIDENT.

J. B. PIERCE, SECRETARY.

NEW BOOK—Second Edition of Hand-Book on the Teeth of Gears, much enlarged and improved. Now contains three Odontographs, a Bevel Gear Chart, the Normal Theory, Etc., Etc. Price one dollar, post-paid. GEO. B. GRANT, 66 Beverly Street, Boston. Agents Wanted.

KEY SEATING MACHINES

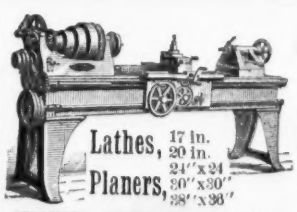
AND

20 in. Drills a specialty.

Our 20 in. Drill is a heavy substantial tool, made for service, has steel shafts and spindle. Gears and racks cut from the solid and have all modern improvements, are made by special machinery, and sold very low.

Our Key Seating Machine will save enough in 60 days' use to pay first cost; no shop can afford to do without one. We have now ready for prompt shipment, both Key Seat Machines and 20 in. Drills. Send for Photo. and Catalogue.

W. P. DAVIS, North Bloomfield, N. Y.



Lathes, 17 in. 20 in.
Planers, 24"x24" 30"x30" 28"x36"

For Prices and Photographs, Write

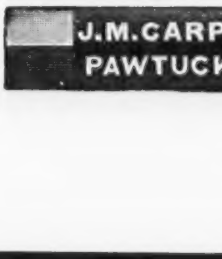
THE G. A. GRAY CO.

SYCAMORE AND WEBSTER STREETS, CINCINNATI, OHIO.

STEEL CASTINGS.

PRATT & LETCHWORTH, PROPRIETORS

Buffalo Steel Foundry, BUFFALO, N. Y.



PUNCHING PRESSES, DIES,

And other Tools for the Manufacture of all kinds of

SHEET METAL GOODS, DROP FORGINGS, —ETC.— DROP HAMMERS.

STILES & PARKER PRESS CO.

MIDDLETOWN, CONN.

Branch Office and Factory 203, 205, and 207 CENTRE STREET, NEW YORK.

J. M. CARPENTER
PAWTUCKET, R. I.

Manufacturer of TAPS & DIES